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>
> Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).
>
> For related information see also *Astronautics*

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> Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.
>
> For related information see also *34 Fluid Mechanics and Heat Transfer.*

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For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

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20 SPACECRAFT PROPULSION AND POWER 1101

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

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Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 1222

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 1223

Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.

Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1223

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.

For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1224

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1225

Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1226

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 1227

Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 1228

Note: N.A. means that no abstracts were assigned to this category for this issue.

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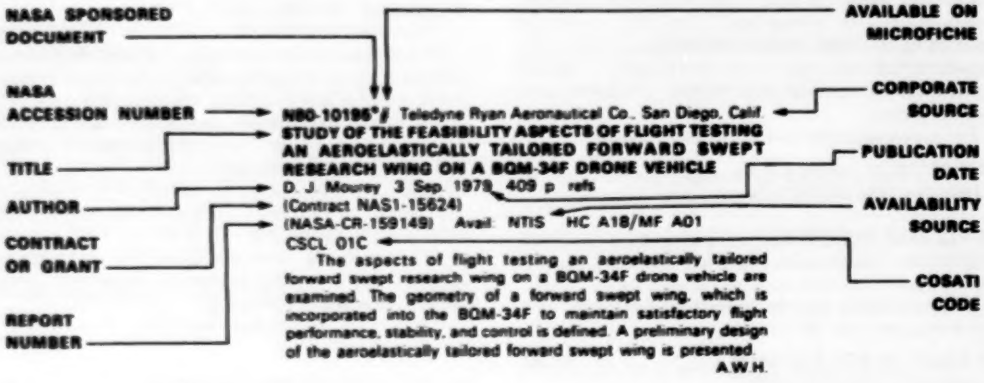
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N80-10195*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
D. J. Mourey 3 Sep. 1979 409 p refs
(Contract NAS1-15624)
(NASA-CR-159149) Avail: NTIS HC A18/MF A01
CSCL 01C

The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.

A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ROTOR SYSTEM RESEARCH AIRCRAFT - MATHEMATICAL MODELLING, STATE ESTIMATION, AND PARAMETER IDENTIFICATION

J.C. Wang, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675902)

Two rotor system research aircrafts (RSRA) have been built to provide the United States Government with the capabilities necessary for the effective and efficient in-flight test and verification of promising new rotor concepts and supporting technology developments. To achieve the RSRA research mission a set of mathematical models will be studied for the design of vehicle flight control laws, estimation of rotor and wing force and moment, and a real-time flight simulation study. The integrated state estimation and parameter identification procedures developed by a NASA contractor will be reviewed and applied to RSRA simulated or real flight test data for estimation of RSRA states, and also for determination of the final structure and parameter values of each mathematical model. The estimated states are to be used for rotor performance analysis and the mathematical models will be used in the design of in-flight control laws. The characteristics of the RSRA instrumentation and recording systems will be analyzed for the RSRA system identification study. Most of the proposed studies will be conducted at NASA-Ames Research Center. A quarterly progress report and a final comprehensive report will be delivered to NASA-Ames.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

1.0002, FLIGHT EVALUATION OF INTEGRATED NAVIGATION TECHNIQUES FOR GENERAL AVIATION

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 7624)

The feasibility of using a simplified Kalman filter to blend air data with multiple VOR/DME data will be analyzed and simulated on HP 21 MX computer and the results will be compared with the actual flight test data at Langley with on-board computers (micro-processors) to process the data.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Aeronautics & Space
Technology

1.0003, MADAIR AIRCRAFT INSTALLATION

R.A. Morrisson, Lockheed California Co., *Burbank, California* 91503 (DN981085; N62269-78-C-0399)

Design and implement aircraft installation for the MADAIR F light test program. This contract supports work unit ZU 701, gency Accession No. DN 681083.

Perform the essential stress analysis, fabrication and preliminary installation effort for the on-board components of the MADAIR system.

SUPPORTED BY U.S. Dept. of Defense, Naval Air
Development Center, Sensors & Avionics
Tech Directorate

1.0004, GAS GENERATOR FUELS STUDY

L. Schipper, Signal Co. Inc., Airesearch Manufacturing Company, *1010 Wilshire Blvd., Los Angeles, California* 90017 (DF190710; F29601-77-C-0074)

Identification of viable alternative(s) to hydrazine for use in gas generators required to drive high power airborne power units.

Fifteen fuels are to be investigated for possible use in high power APU systems. The contractor will develop a parametric weighting system for selection of candidate fuels. A detailed fuel specification and duty cycle are provided for development of the weighting system. The range of interest is from 3,000 to 20,000 shaft horsepower.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons
Lab.

1.0005, AERONAUTICAL TECHNOLOGY, TECH AREA K - FLIGHT SIMULATION

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0D5000)

Perform analyses and design studies to determine the requirements of a rotary-wing R&D flight simulator capable of simulating NOE flight operations. This effort complements the hardware development being conducted under 6.3 Project DB34.

In joint participation with NASA, perform the studies with the expectation of providing modifications and additions to an available NASA simulator to meet the Army's mission requirements.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research &
Development Command, Aeromechanics
Lab.

1.0006, HELICOPTER AIRBORNE INSTRUMENTATION SYSTEM

J. Strock, Schlumberger Ltd., EMR Telemetry, *Fruitville Rd., P.O. Box 3041, Sarasota, Florida* 33578 (DA0D4935; DAAK11 79 C 0033)

Current airmobile doctrine necessitates operations in flight regimes which cause high aircrew workload. This instrumentation package is needed to make quantitative assessments of aircrew performance. Data collected will be used to make design recommendation related to improving aircrew interaction with the helicopter. Instrumentation will consist of the installation to appropriate transducers to measure specified helicopter control and helicopter state variable. These signals will be processed for both recording on magnetic tape and relaying telemetry to a ground station. Acquire an airborne instrumentation system to assess aircrew performance over a wide range of operational conditions.

Furnish an airborne instrumentation system to be installed on a UH-1 helicopter by the USAHEL. System to be supplied shall consist of an airborne data collection system, tape recording system along with ground station hardware and software needed to convert airborne taped data into engineering units for analysis.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Human Engineering Lab.

1.0007, ADVANCED TRANSONIC W/B DESIGN METHODOLOGY

M.E. Lores, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF141350; F33615-78-C-3014)

The Air Force function for this effort is the design development of both transport and fighter aircraft. Transports, which cruise at transonic speeds, and fighters, which maneuver at transonic conditions, have been designed in the past by use of 2-D transonic and 3-D subcritical methods, although most problems are 3-D and transonic in nature. The objective of this effort is to develop more efficient transport and fighter configurations than possible in the past and at a lesser cost. This work will contribute to more fuel efficient transports and more maneuverable fighters at transonic speeds as well as reducing the cost of designing these aircraft.

Recently developed 3-D transonic methods will be incorporated into a design procedure and applied to the development of a transport and a fighter configuration. The configurations will be tested in a wind tunnel and the results of the tests will be used to verify or improve the computer code.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight
Dynamics Lab.

1.0008, TORSION-BENDING FLUTTER OF VISCOELASTIC WINGS

H.H. Hilton, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

An analysis of subsonic and supersonic torsion-bending flutter, including rotary inertia, shear and heating effects, of a time-dependent linear viscoelastic lifting surface consisting of either a Bernoulli-Euler or a Timoshenko beam is formulated using aerodynamic strip theory. Complex moduli models for aluminum are characterized as functions of temperature and frequency by fitting Chebyshev polynomials to actual material experimental data.

The flutter analysis is carried out in the complex plane and a computerized iterative method for the determination of flutter speeds and frequencies is developed. The influence of viscoelastic material properties (storage and loss moduli) temperature, rotary inertia and shear effects is evaluated. The results of the analysis show that in the presence of viscoelastic material damping it is possible to obtain flutter velocities and frequencies which are smaller than undamped elastic ones for the same geometric lifting surface.

The effects of structural damping in combination with viscoelastic damping are also under investigation.

SUPPORTED BY University of Illinois

1.0009, A NEW APPROACH TO FLIGHT CONTROL SYNTHESIS VIA OPTIMAL PILOT MODELING

D.K. Schmidt, Purdue University, School of Aeronautics & Astronautics, Dept. of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (0294-56-1282)

Given adequate design specifications, or aircraft handling qualities criteria, and a valid system model, design techniques, particularly modern control approaches, are available to system designer for synthesizing even the most complex flight control systems. Unfortunately, however, weaknesses exist in both the design specification and modeling areas for non-conventional aircraft such as V/STOL and control configured vehicles (CCV's). The assertion here is that due to the 'non-conventional' multi-variable nature of the vehicle and the piloting task, and due to the anticipated complexity of the systems involved, a 'non-conventional' approach to the control design problem is worthy of investigation. The program would consist of the development and simulator evaluation of a design approach usable in the absence of quantitative handling qualities specifications, and yet explicitly include design objectives based on pilot rating concepts by means of an analytical pilot model. The proposed procedure involves the unique approach of simultaneously solving for the stability augmentation system (SAS) gains and pilot model via optimal control techniques. The program is just getting under way.

SUPPORTED BY Purdue Research Foundation

1.0010, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRCRAFT STABILITY AND CONTROL ANALYSIS AT HIGH ANGLES OF ATTACK

R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DN675668; N00014-76-C-0780)

At high angles of attack, the flying qualities of most high performance aircraft deteriorate due to undesirable characteristics such as pitch-up, roll coupling, wing rock, and directional divergence. These characteristics significantly reduce tracking capability and maneuverability, and often lead to loss of aircraft control. This program will develop an analytical framework of study for this flight regime, and identify designs of departure preventing control systems. The analysis is based on the bifurcation and catastrophe theory methodology (BACTM).

Utilizing six degree of freedom equations of motion and a fighter aircraft model equilibrium and bifurcation surfaces will be generated for the stall/spin flight regime. Aircraft flight test data will be used to verify the resultant surfaces as functions of aircraft control parameters. The theory will be applied to spin equations of motion to investigate the cause of post stall divergence, and techniques for spin prevention and recovery will be investigated. Simulation tests will be conducted to validate high angle of attack control techniques and test out the spin prevention and recovery techniques which are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

1.0011, EFFECT OF DESIGN VARIANCES AND MANUFACTURING TOLERANCES ON THE STRENGTH AND LIFE OF MECHANICALLY FASTENED COMPOSITE JOINTS

S.P. Garbo, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF140840; F33615-77-C-3140)

The efficient joining of the various composite materials involves the identification of parameters affecting joint strength and life, establishment of design approaches for military aircraft applications, and compilation of design data. In many cases, the manufacturing tolerances and quality acceptance limits used in the design of anisotropic composite joints are the result of practices developed from homogeneous metal joint test data implemented in aircraft structures for many years. The objective of this effort is to develop a failure criteria specifically for mechanically fastened anisotropic composite material joints. The payoff will be increased usage and lower production costs of composite military aircraft components without compromising reliability of the composite joints.

The approach taken in this effort will be to perform selective experiments to determine the effect of manufacturing (such as hole clearance and location tolerances) and design (such as irregular fastener spacing) tolerances on the static strength and fatigue life of bolted joints in graphite-epoxy composite structure. Failure mechanisms for the joints will be postulated based on prior experience and experimental observations and combined with accurate stress analyses to develop a failure criterion which shall be verified by additional experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight
Dynamics Lab.

1.0012, TRANSONIC SEPARATED FLOW STUDIES FOR NAVAL AIRCRAFT

T.J. Falk, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN123228; N00014-76-C-0630)

The performance of aircraft at transonic speeds is severely limited during maneuvering by adverse shock-boundary layer interactions and flow separation on the wing. Though the effects of these phenomena on the aerodynamic characteristics have been studied in the laboratory, the measurements have inadequately simulated viscous effects - resulting in serious problems when the laboratory data have been applied to the design of full-scale aircraft. The present investigation will study, experimentally, shock boundary layer interaction at transonic speed with full-scale viscous simulation to provide basic data leading to a more complete understanding of these complex flows and to provide for the development of viscous scaling laws.

Accurate aerodynamic data for aircraft and missile design needs require matching the Reynolds number as well as the Mach number in laboratory tests. Because of the extreme expense of conventional laboratory equipment to accomplish this match at transonic speeds, such testing has usually been performed at reduced Reynolds numbers - leading in several instances to serious airplance deficiencies. The present investigation will study shock boundary layer interaction at full-scale Reynolds numbers at transonic speeds in a short duration tube wind tunnel. Though the running time will be short, about 40 milliseconds, sufficient time will be available to develop steady flow, and enable total pressure and static pressure surveys to be made. In the interaction region, the surface shear and wall static pressure will be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

1.0013, ADVANCED CARBON BRAKES FOR FIGHTER AIRCRAFT

B.J. Brookman, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF140890)

This effort supports the development of design and performance criteria and test techniques required for the optimum use of advanced carbon brakes on Air Force aircraft. Air Force aircraft incur high operational costs and down times due to maintenance and replacement costs of aircraft brakes. The objective of this program is to evaluate the potential of carbon-carbon composite materials used in aircraft brakes, and to develop standards and specifications for carbon brakes for future USAF aircraft. Potential advantages are lighter weight resulting in increased payload or lower fuel costs, better friction characteristics resulting in more efficient gear structure, and longer wear life resulting in lower acquisition and maintenance costs per landing and less down time.

A series of dynamometer tests will be conducted on three brake sizes (13 inch rim 2 rotor, 16 inch rim 4 rotor, and 18 inch rim 3 rotor) to evaluate the performance characteristics of carbon materials in aircraft brakes. A total of 8 carbon brakes with construction and material variations will be tested, along with two beryllium and one steel brake in order that the carbon performance may be assessed by comparison with more conventional materials. Brake performance will be evaluated as a function of energy level, rate of energy input, brake temperature, and brake wear rate. Additional sizes and carbon material variations shall be included in the test program as they are developed and become candidates for current and future aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight
Dynamics Lab.

1.0014, AIRCRAFT PARAMETER EXTRACTION USING UNSTEADY AERODYNAMIC FORCE MODELS

W.R. Wells, Wright State University, School of Science & Engineering, Dept. of Engineering, *Dayton, Ohio* 45431 (DF139660; AFOSR-77-3220)

This work unit supports the AFFDL/FGC basic research plan that is intended to provide experimental methods to validate theoretical unsteady aerodynamics. The identification of these experimental unsteady aerodynamics will provide for safer control of aircraft flight. The specific objective of this unit is to develop a parameter estimation procedure for unsteady aerodynamic terms associated with body fixed axis system motions. Results may be incorporated into flexible aircraft parameter estimation procedure in FY-78 time period. When these experimental data are better estimated and incorporated, the aircraft response to conventional and advanced control systems will be more predictable.

State equations of symmetric motion of an aircraft's body fixed axis system are to be developed from fundamental solutions of partial differential equations of potential flow. The aerodynamic parameter of a, b(t), c in the state equation dx/dt equals ax(t) plus b(t)x(t) plus cu are then estimated for linear and nonlinear equation cases.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight
Dynamics Lab.

1.0015, MM&T - APPLICATION OF THERMOPLASTICS TO HELICOPTER SECONDARY STRUCTURES (DA0E3869)

D.J. Hoffstedt, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G0013; DAAK51-79-C-0019)

This manufacturing methods and technology (MM&T) program is to expand thermoplastic manufacturing technology to fabricate full-scale flightworthy secondary structures with a reduced cost as compared to epoxy composite and metallic counterpart components. Selection of the best overall fabrication technique will be conducted by investigating limitations of various vacuum-forming processes.

Work will consist of detail structural design refinement and configuration and material selection for the engine access door assembly for the CH-47 aircraft through element demonstration; tooling development; and, finally, fabrication of full-scale helicopter components. Tests will be conducted in order to perform comparative analysis (cost, structural integrity, weight, repair/maintenance characteristics) with the metallic and/or thermoset (epoxy) counterpart.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research &
Development Command, Applied
Technology Lab.

1.0016, CANOPY INTERNAL GLINT CONTROL

D. Piccioni, Boeing Co., Vertol Division, *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0E3854; DAAK51 78 C 0009)

Develop a kit to eliminate or reduce helicopter (AH-1S) canopy reflections caused by instrument panel lighting.

Research has established that a light control film developed by the 3M company has the potential, if selectively applied, of eliminating or reducing canopy reflections from instrument lighting that cause night flight problems. This effort will use this method in the design and fabrication of an experimental kit for solving this problem for the AH-1S (production) helicopter. The kit will subsequently be tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research &
Development Command, Applied
Technology Lab.

1.0017, ALL-COMPOSITE GENERAL AVIATION AIRCRAFT

R.O. Stearman, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: In 1977, the first FAA certified all-composite aircraft was donated to the Aerospace Engineering and Engineering Mechanics Department of the University of Texas at Austin. Several flight research programs are being developed with this aircraft. These include an investigation of a mechanism of noise transfer into a composite aircraft cabin environment, an investigation of the influence of winglets on aircraft performance and a study of subcritical flight flutter testing techniques for general aviation aircraft. On-board digital data acquisition and recording systems are being developed for these programs. The study attempts to initiate a general aviation research program within the department.

SUPPORTED BY University of Texas

1.0018, HT 79-14- A REPRESENTATIVE SUMMARY OF THE AH-1G AERODYNAMIC AND STRUCTURAL LOADS SURVEY DATA

D.J. Merkley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3864)

Stimulate interest in and awareness of the quality, comprehensiveness and versatility of the AH-1G operational loads survey (OLS) data bank and the data management and analysis system DATA-MAP (data from aeromechanics' test and analytics - management and analysis package), formerly known as OLS-DMS. The OLS data bank contains simultaneously recorded data from an extensively instrumented AH-1G which includes blade surface pressures, leading edge stagnation data, local blade flow velocities and directions, blade accelerations, bending moments and attendant responses in the control system and airframe. The potential of the OLS data bank with respect to the Army's needs will be realized through increased interest and awareness.

Survey selected aerodynamic and structural data with corresponding flight-test conditions for representative steady-state and transient maneuvers convering the range of the OLS flight envelope. The resulting set of reduced data will be documented in plotted format utilizing DATA-MAP to illustrate the extent of flight conditions and magnitude of the various types of data available.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research &
Development Command, Applied
Technology Lab.

1.0019, NEW REMOTELY PILOTED VEHICLE, RPV, LAUNCH AND RECOVERY CONCEPTS DEVELOPMENT

R.F. Yurczyk, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137610; F33615-78-C-3404)

The advanced remotely piloted vehicle (ARPV) has been assigned a definite role in support of combat operations in conventional warfare. A critical link in this role is a capability for high sortie rates and fast turnaround times, which are iargely controlled by the effectiveness of the launch recovery system. The objective of this effort is to study several air cushion launch/recovery systems and an air bag skid landing system in terms of system dynamics, operational capability, and cost. This study will allow a valid evaluation of the effectiveness of these systems to be made.

A dynamic model of two basic RPV airframes combined with several different air cushion systems and an air bag skid system shall be made and their dynamic response studied to determine optimum configurations. preliminary designs incorporating the results of the analysis shall be made. A performance and cost study of the various systems shall be done.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight
Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, EVALUATE AND MODIFY VIKING LANDER X-RAY FLUORESCENCE ANALYZER

W. Kelleher, U.S. National Aeronautics & Space Admin., Office of Aeronautics & Space Technology, Langley Research Center, *Hampton, Virginia* 23665 (D7-0053; J884A-029)

OBJECTIVE/APPROACH: The objective of this project is to convert the X-ray fluorescence analyzer developed for the Viking spacecraft for use in water monitoring applications. First a detailed evaluation of problems regarding detection limits, preconcentration, cooling, etc. will be made to determine the potential for adapting the instrument. If adaptation appears economically feasible, identified modifications will be made to the unit and it will be field tested.

FINAL OUTPUTS: 1. A report on the feasibility and anticipated problems of converting the X-ray fluorescence unit for use in water monitoring will be delivered. 2. If approved, a report on modifications made and results of tests will be prepared.

PROGRESS: An existing IAG with NASA-Langley has been modified to permit this work. Conversations with other researchers have identified many potential problem areas which must be addressed. Work at NASA-Langley is presently being initiated.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Systems
Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, A STUDY OF THE REDOX PHOTOCHEMISTRY OF A NUMBER OF IRON COMPLEXES

J.L. Reed, Atlanta University, School of Arts & Sciences, Dept. of Chemistry, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NSG 8019)

It has been proposed that ferric and ferrous complexes may be utilized in converting solar energy to more useful forms. However, although a number of reports on the photochemical behavior of iron complexes have appeared in the literature, our understanding of these phenomena is still very incomplete. It is the objective of this investigation to examine a number of iron complexes in an effort to obtain a more complete understanding of their behavior.

Of particular interest in this study is the mechanism(s) operative in oxidation-reduction of iron complexes and related model compounds. To be examined are: the energy state(s) responsible for the effects of solvent and temperature on the process and energy transfer processed.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

3.0002, POLYMER FRACTOGRAPHY - A SCANNING ELECTRON MICROSCOPY ATLAS OF FRACTURES

E.J. Korda, Atlanta University Center Corp., Science Research Institute, *360 Westview Dr. S.W., Atlanta, Georgia* 30310 (KSC 80-1)

The purpose of this investigation is to study the fractured surfaces of polymeric materials (i.e., elastomers, amorphous and crystalline polymers, etc.) using the scanning electron microscope to document representative features to produce an atlas of fractographs that can be utilized in the identification of failure modes. Initially, brittle and ductile polymers fractured by tension and fatigue are being studied.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
John F. Kennedy Space Center

3.0003, CHARACTERIZATION OF THE PHYSICOCHEMICAL PROPERTIES OF POLYMERIC MATERIALS FOR AEROSPACE FLIGHTS

M. Rock, Bowie State College, Graduate School, Dept. of Chemistry, *Bowie, Maryland* 20715 (NSG 5009)

Materials of interest to Goddard Space Flight Center are routinely tested in a vacuum at 125 degrees C, at Greenbelt, to determine their outgassing properties. This affects their suitability for use in space modules. It is our object to extend the range of these tests to higher and lower temperature ranges than those usually run at Goddard Space Flight Center. Further, we have the capability of testing materials in air or inert atmosphere as well as in vacuum.

We use a Dupont 900 Differential Thermal Analyzer (DTA) and an auxiliary Dupont 950 Thermogravimetric Analyzer (TGA). The TGA enables us to measure outgassing - via weight loss - from 20 degrees to 500 degrees C. The DTA indicates exothermic and endothermic changes over the same range. We are currently running the standard DTA and TGA tests.

We are also doing research for the battery analysis program.

Nickel-cadmium batteries sometimes fail in use. It is useful to analyze similar cells, of the same batch, which have been subjected to the same conditions.

We are developing calibration curves for atomic absorption spectroscopy. The curves involved are for Ni, Cd and Co. Calibrations are also being made for mixtures.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

3.0004, HOMOGENEOUS AND HETEROGENEOUS TERNARY COMPLEXES INVOLVING NUCLEOTIDES, METAL CATIONS AND AMINO ACIDS

J. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660902)

Ternary coordination complexes involving 5'-nucleotides, amino acids, and metal ions play an important role in contemporary biological processes such as replication, transcription, and amino-acylation. Clay surfaces containing metal ions in the matrix can be considered to be close inorganic analogs to ternary systems in biological processes. Clay surfaces are of interest to chemical evolutionists because they have recognized the possibility of specific adsorption and thus concentration of biological or prebiological molecules on these surfaces leading to condensation. It is the intent of this investigation to evaluate stability constants and selectivity for aqueous mixed-ligand, ternary systems involving nucleotides, metal ions and amino acids and compare these results to the analogous ternary systems of homometallic clays, nucleotides, and amino acids. This comparison should allow conclusions to be drawn as to the necessity of clay surfaces in the formation of metal ternary complexes leading to condensation products or biopolymers in chemical evolution. The results should be significant in determining the direction of future endeavors involving polymer absorption and condensation on homometallic clays. A final written report embodying the results of the collaborative research shall be submitted.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0005, SMECTITE CLAYS IN MARS SOIL - EVIDENCE FOR THEIR PRESENCE AND ROLE IN VIKING BIOLOGY EXPERIMENTS

J.B. Orenberg, California State University & Colleges, San Francisco State University, School of Science, Dept. of Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 7512)

This investigation is intended to show by experiment the hypothesis that if clays are major components of the fine Martian soil, then most of the results of the Viking biology experiments were caused by and can be explained on the basis of clay surface activity in catalysis and gas adsorption. The first year of this study showed that the Viking Labeled Release (LR) reaction could be simulated with certain clays; labeled carbon was released from the medium solution used in the Viking LR experiment when reacted with clays at rates and quantities similar to those measured by Viking on Mars. The component in solution that decomposed most readily was formate; the decomposition is postulated to be iron catalyzed on the clay surface. The reaction rate was affected by pH, type of exchangeable ion, salt concentration and preheating. It is planned to continue the study of the effects of water content, salt content and salt composition in the clay in LR experiments. Experiments also will be initiated to study the carbon fixation reaction similar to that occuring in the Viking Pyrolytic Release carbon assimilation experiments. The results of these studies will allow a better understanding of the Mars soil chemistry (its effects on the planet's water and volatiles balance) and its geological history.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Space Science

3.0006, FIBER RELEASE BY MECHANICAL LOADING & THERMAL EXPOSURE FROM FIBER REINFORCED POYMERIC COMPOSITE MATERIAL AIRCRAFT PARTS (ABBREV)

R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, *Washington Sq., San Jose, California* 95192 (NSG 2332)

The objectives of the project are: 1. To study the amount and size of carbon fiber released when the composite material panels were subjected to a) impact and fire, b) fire alone and c) fire and impact. 2. To measure the mechanical properties of composite materials in tension and flexure with and without aging the material in different weathering conditions. 3. To measure the thermal properties like thermal conductivity, specific heat and thermal expansion coefficient. 4. To measure the impact resistance and vibration damping and elastic modulus at different temperatures.

The first objective has been completed by designing the required test set-ups and analyzing the test results. The fiber release is correlated with time of fire, velocity of gas flow, structure of the material.

The current emphasis is on measurement and correlation of the mechanical and thermal properties of composite materials. Ten candidate composite materials have been tested using different test equipment. These test results are useful in characterizing the composite materials for strength, modulus, fracture toughness, impact strength under different environmental conditions and temperatures. These data are also applied in processing composite materials to test different curing cycles and resins.

The thermal properties are required to calculate the spalling resistance of composite materials. These tests are also planned to be run.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0007, A STUDY OF FIBER MATERIALS FOR USE IN TEMPERATURE RESISTANT FIBER REINFORCED COMPOSITES

R.N. Anderson, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, *Washington Sq., San Jose, California* 95192 (NCC 2-3)

The objective of this project is to evaluate the high temperature characteristics of commercially available and developmental refractory fibers for use in fiber reinforced composites. Specifically, the structure of an aluminoborosilicate fiber has been studied in detail as a function of temperature utilizing x-ray diffraction analyses and scanning electron microscopy to determine its structural limitations and capabilities. In addition, developmental fibers recently synthesized are being studied and modified to improve their properties for use in fiber reinforced composites.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0008, AN INVESTIGATION OF TOXIC HAZARDS FROM BURNING MATERIALS IN CONTROLLED FIRES

R.C. Ballard, California State University & Colleges, San Jose State University, School of Science, *Washington Sq., San Jose, California* 95192 (NCC 2-4)

The goals of this investigation are to examine the egress capacity, exposure toxicity, and subsequent pathology in Sprague-Dawley rats when exposed to manufactured materials that are burned so as to duplicate a fire scenario.

Progress is currently being made in developing and assemblying the necessary materials and equipment for these evaluations.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0009, A STUDY OF PROCESSING PARAMETERS FOR NON-METALLIC COMPOSITES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2209)

Durable, lightweight, structural materials can be made from polymer containing composites. These materials often have low fire resistance. Improving the fire resistance of the polymer by including halogen often results in undesirable side effects, e.g., toxic fume evolution on burning.

The objective of this grant is to produce fire-resistant polymers without resorting to halogenation. One approach is to increase the char forming tendency by incorporating multiply bonded aromatic groups in the polymer structure. Materials containing pendant fluorene groups have been synthesized and are being evaluated for their processability and their thermal and flammability characteristics.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0010, CHARACTERIZATION AND DEGRADATION STUDIES ON AROMATIC POLYIMIDES AND POLYESTERS

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2274)

The objective of this study is to characterize a number of polymers for potential use in aerospace applications, and to study their thermal degradation reactions.

The thermal, physical and chemical properties of different polymers are being obtained and compared using thermogravimetric analysis, differential scanning calorimetry, dynamic mechanical analysis and thermal conductance measurements. The char and the volatile materials evolved under thermal degradation of various polymers have been examined using gas chromatography-mass spectrometry, infrared, nuclear magnetic resonance spectroscopy, elemental analysis and other analytical tools and methods. Some model compounds have been synthesized and studied.

Preliminary data on (1) photo/thermal degradation of an aromatic polyimide (Kapton), (2) photo/thermal degradation of polyester (based on bisphenol fluorene or bisphenol A and 50/50 iso-/terephthalic acid), (3) thermal oxidation and degradation of epoxy resins (MY 720-DDS, Epon 828-DDS) and (4) dynamic mechanical analysis of various composite resins (MY 720-DDS, Epon 828-DDS, Narmco 5208, and MXG 6070) are reported.

The research will carry out detailed thermal chemical and physical characterization on advanced composite resins such as polystyrylpyridine, bismaleimide polymer and epoxy resins based on the bisphenol fluorene system.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0011, APPLICATION OF X-RAY FLUORESCENCE SPECTROMETRY TO WATER QUALITY ASSURANCE

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NSG 2305)

The objective of these studies was to develop analytical methodologies based on X-ray fluorescence (XRF) spectrometry that will provide fast real-time (less than 20 minutes) simultaneous multi-element determination of inorganic elements as fractional parts-per-billion levels in municipal drinking water and reclaimed waste-water. A second aspect of this project was to develop this package in such a manner that it could be mounted in a mobile 30' trailer along with up to 17 other such analytical modules, thus forming a complete mobile water quality assurance laboratory.

The primary inorganic species of interest are the 8 elements covered by US EPA regulations for drinking water, and experimental work is based on energy dispersive XRF utilizing isotopic excitation (chosen deliberately in view of the space limitations and portability requirements dictated by use in the trailer). In view of parallel development work by the Magnovox Corporation via EPA grants which has concentrated on cationic species, we have directed our attention to the anionic species Cr(VI), As, and Se.

Experimental work has been completed that examines the kinetics of anion exchange on thin membranes, pH and temperature control, potential oxidation state changes by anionic analytes, and interferences from other higher concentration anions. Preliminary work has been conducted to allow development of calibration standards, and absolute trapping efficiencies for the commercially supplied anion exchange membranes have been determined for each element under of variety of conditions.

Experimental work continues on the analytical methods needed for real samples, or the optimum method of preparing and using absolute and relative standards, and on the distribution of inorganic pollutants between bulk water and particulates. Alternate methodologies for pre-concentration techniques will be examined in more detail.

Co-operation with the Santa Clara Valley Water District, and use of their facilities at the Palo Alto, California, wastewater reclamation plant, are gratefully acknowledged.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0012, INORGANIC CRYSTAL CLATHRATES - FIRE CONTROL INVOLVING INORGANIC MICRO-ENCAPSULATION & THERMALLY CONTROLLED RELEASE (ABBREV)

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The major objective of this program was to develop a new or improved fire extinguishant system based on dry chemicals that will not only extinguish fuel fires with a continuous source of fuel (i.e. a broken fuel lead feeding an ignition source such as an electrical fault or adjacent hot surface), but which will prevent the fire from re-igniting after extinguishment even though the supply of fuel is still present and has not been terminated. In particular, we were concerned with fires localized in engine compartments of aircraft. Since fire is a chemical phenomenon it should be controllable by chemical means, and both experimental and theoretical methods have been used to produce, develop, and successfully test a new concept in fire control.

Experimental work has now been completed wherein a group of new chemicals have been characterized, their synthesis by new methods developed and optimized, and shown to possess special properties that satisfy several requirements predicted for fire control. Based on these new chemicals, model systems have been formulated, developed, and successfully tested under a variety of conditions pertinent to aircraft engine nacelle fires. These model systems have proven to be more effective than any commercially available fire extinguishants, and more effective than any other known experimental systems. A theoretical model has been developed and refined that appears to describe fire control mechanisms better than any previous models, and which is supported by a considerable body of experimental data obtained for a variety of conditions.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Org. & Management, Office of
University Affairs

3.0013, RADIATION CHEMISTRY STUDIES OF CARBON SUBOXIDE POLYMERS - AN INVESTIGATION OF A PROPOSED PRE-BIOTIC LINK TO THE ORIGINS OF LIFE

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The objective of this program is to examine a self-consistent hypothesis for the formation of life-bearing molecules from a simple inorganic substances such as carbon monoxide and carbon dioxide, and which provides a viable alternate to the currently accepted 'primeval soup' hypothesis. More importantly, this alternate hypothesis could account for the formation of life-bearing molecules on planets that are devoid of water and reduced carbon precursors such as methane, conditions that are difficult to reconcile with the 'primeval soup' hypothesis, and are just the conditions that obtain on Mars and Venus according to data received from the planetary probes sent to these planets.

The experimental work is being carried on under three broad categories, directed by three faculty members: One group is examining the physical-organic aspects of reaction mechanism pathways, directive effects, and product distributions; a second group is concerned with inorganic aspects of the postulated polymeric intermediates, surface induced polymerization effects, and configurational properties of polymer growth; a third group is examining the radiolytic and photolytic effects induced by various energy input and transfer processes (photolytic, radiolytic, tribo-luminescent, and magnetic).

Experimental work continues under these same three broad categories, and will include the study of model compounds such as substituted alpha-pyrones, circular dichroic measurements of polymeric materials grown under intense local magnetic/electrical fields, stabilization of excitation centers, and specific radical attack phenomena induced by microwave discharges.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0014, ENVIRONMENTAL STABILITY OF COMPOSITE RESIN MATRICES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, ***Washington Sq., San Jose, California*** 95192 (NSG 2353)

The objective is to study the photooxidative and hydrolytic degradation of baseline and advanced composite resins as part of an assessment of their long-term environmental stability as matrices for fiber-reinforced composites. Baseline matrices consist of epoxy resins based on diglycidyl ether of bisphenol A (e.g., Epon 828) or tetraglycidylmethylene dianiline (e.g. MY 720), while advanced matrices include epoxy resins based on blends of diglycidyl ether of bisphenol A and diglycidyl ether of bisphenol fluorene, phenolic novolacs, bismaleimides and polystyryl pyridine. The mechanisms by which these resins degrade under the influence of ultraviolet radiation, oxygen and moisture are being investigated with the aid of infrared spectroscopy and scanning electron microscopy. This work focused on the effect of degree-of-cure on the photooxidation of Epon 828 and MY 720 resins, both cured with diaminodiphenylsulfone (DDS). The standard-cured MY 720/DDS resin was found to photooxidize at a much slower rate than the corresponding under- or overcured resins. This finding was confirmed by accelerated weathering tests. In contrast, Epon 828/DDS resins, whether standard, under- or overcured, all showed essentially the same rate of photooxidation and the same rate of accelerated weathering.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0015, MODIFICATION OF POLYMERIC SUBSTRATA FOR THE GAS CHROMATOGRAPHIC ANALYSES OF CO, CARBONYLS AND O2 IN ATMOSPHERES

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STATEMENT OF THE PROBLEM: To chromatographically separate and identify the components of planetary gases with emphasis on carbon monoxide, carbonyls and oxygen. In order to analyze light gases successfully, all gaseous constitutents must be adequately separated from each other. Examples of generally difficult separations include N2/CO,Ar/CO,. N2/O2 and Ar/O2. Carbonyl (C double bond O) containing molecules are expected to be found along with hydrocarbons, nitrilic species and amines, from which they will have to be separated. With deliberate and controlled retardation of the oxygenated species, the problems of peak coincidence can be resolved. The gases that are being described are those anticipated in the analysis of planetary atmospheres during future unmanned missions.

GENERAL APPROACH TO BE APPLIED: The investigation of physically enclathrated di-oxygen retarding chelate species by di-vinylbenzene polymers will provide the basis for experimentally resolving peak coincidences.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0016, GRAPHITE-EPOXY COMPOSITE PROTECTIVE COATINGS

L.A. Mayer, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Chemistry, ***Washington Sq., San Jose, California*** 95192 (NSG 2371)

STATEMENT OF THE PROBLEM: To prevent or delay the onset of a form of self-sustained oxidation ('smoldering combustion') of composites subjected to hyperthermal environments; to prevent or delay the irreversible loss of composite properties subjected to hyperthermal environments.

APPROACH TO BE APPLIED: The investigation will be directed toward determining the effectiveness of non-intrusive thin film coatings as it relates to the problem statements. Preliminary evidence suggests the viability of the above approach. Continuing efforts will be directed at determining the feasibility and suitability of inorganic-intumescent/ablative coating systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0017, OXYGEN EFFECTS AND EARLY BIOCHEMICAL EVOLUTION - ACETYL-COA SYNTHETASES OF YEAST

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The unicellular eucaryote, S. cerevisiae can grow with and without the presence of oxygen during growth. The major objective is to study the effects of oxygen on some biochemical processes in this yeast, with special reference to the enzyme acetyl-CoA synthetase. This organism produces two different isozymes depending on the availability of oxygen. The effects of oxygen on the production of these two isozymes will be studied. Attempts are directed towards purification of the enzyme elaborated under anaerobic conditions. Immunology coupled with classical enzymological approach are being used towards this goal.

The technique to obtain monoclonal antibodies without specific immunization is being used, since the non-aerobic isozyme is labile to all purification techniques. Preliminary data with aerobic isozyme has revealed the technique can be adapted to the enzyme of non-aerobic origin.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0018, CHARACTERIZATION AND FORMULATION OF FLUOROCARBON ETHER ELASTOMERS

G.A. Selter, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, ***Washington Sq., San Jose, California*** 95192 (NSG 2186)

The requirements of high-performance aircrafts have led to making use of internal cavities in the wings and other parts of the aircraft for fuel storage. The objective of this proposed research is to synthesize and thoroughly characterize new sealant materials for the interior of aircraft fuel tank. Spectroscopic, chromatographic, kinetic, thermogravimetric, calorimetric, and mechanical methods of analysis are being used to optimize conditions of new elastomer synthesis and limits of their applications. A process for simultaneous chain extension and crosslinking was developed whereby oxadiazole and triazine rings are formed to serve as linkages. Several perfluoroalkylether polymers with different chain length and crosslink density were successfully prepared and characterized. These polymers have excellent low-temperature flexibility, low modulus, and high thermal stability.

Recently a new technique using triazine ring system for both chain extension and crosslinking has been developed which simplifies the curing process and produces much better sealant materials in almost every aspect. However, the properties of perfluoether polymers are determined by the chain length and crosslink density, so optimization of these factors will be investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0019, ANTIREFLECTION COATINGS FOR SOLAR CELLS

K.S. Sree Harsha, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Materials Science, ***Washington Sq., San Jose, California*** 95192 (NSG 2355)

This program is directed at the development of new materials and a new fabrication method for the deposition of antireflection (AR) coatings on existing photovoltaic cells. The new AR coating material to be investigated is nonstoichiometric silicon oxynitride. The new AR coating deposition process to be used is plasma enhanced chemical vapor deposition. These silicon oxynitride coatings will be inhomogeneous, i.e., the composition of the coatings will have a spatial gradient in their refractive index.

The current status of this program is: a) Design calculations for optimal refractive index profiles of dielectric coatings have been completed for a variety of coating thicknesses and cell encapsulation materials, and b) The plasma reactor has been constructed and is currently being inspected by the safety department prior to its use.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

3.0020, ANALYSIS AND INVESTIGATION OF AEROSPACE BATTERIES

P.P. McDermott, Coppin State College, Undergraduate School, Dept. of Chemistry & Physical Sciences, *2500 W. North Ave., Baltimore, Maryland* 21216 (NSG 5051)

The object of this research has been to improve the life and reliability of aerospace batteries through the investigation of cell degradation and factors that limit cell life. Under this program, a full-time Research Associate directs the analysis of test cells at the Goddard Space Flight Center's Electrochemical Analysis Laboratory and trains Coppin State College students in techniques of chemical and electrochemical analysis.

The Principal Investigator has studied a number of areas related to cell degradation, including positive plate determination, cadmium migration, electrolyte relocation, and the changes in electrode morphology with aging. Results of these studies have been reported extensively in the Proceedings of the GCFC Battery Workshop, Extended Abstracts of the Electrochemical Society, Proceedings of the Power Conference, and the IECEC.

Future work will include examination of the voltage data as a means of assessing the state of the battery deterioration and extension of research into the area of Lithium batteries.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of Org. & Management, Office of University Affairs

3.0021, LASER INDUCED PHOTOLUMINESCENCE STUDIES OF PRIMARY PHOTOCHEMICAL PRODUCTION PROCESSES OF COMETARY RADICALS

W.M. Jackson, Howard University, School of Liberal Arts, Dept. of Chemistry, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5071)

The primary quantum state distributions of dark fragments following photodissociation have been measured for H_2O, C_2N_2 and HC_2CH, as part of an ongoing program to investigate the dynamics of photodissociation. Such energy distributions are important for understanding cometary spectra. A powerful Nd-YAG pumped dye laser system with frequency mixing and anti-Stokes Raman shifting will be used in this program as a narrow band photolysis source in the near VUV to expand this work.

The photochemical lifetime of OH in comets at 1 AU has been calculated to to be between 7x10 to the 4th power and 2x10 to the 5th power sec, depending on the radial velocity of the comet. The first observations of cometary spectra using IUE were made of Comet Seargent 1978m.

Finally photodissociative excitation using an atomic resonance lamp has shown that NH_3 and N_2H_4 may be qualitatively identified and quantitatively measured at the pressures that may be encountered in a cometary mission. Using f/1 optics the sensitivity has been conservatively estimated at 10 to the 10th power molecules/cc for a 100 sec counting period.

BIBLIOGRAPHIC REFERENCES: The Lifetime of the OH Radical in Comets at 1 AU, W.M. Jackson, in press, Icarus (1979). IUE Observations of Comet Seargent 1978, W.M. Jackson. Astronomy and Astrophysics, 73, L-7 (1979).

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

3.0022, AQUATIC PLANTS AS FILTRATION SYSTEMS FOR CHLORINATED HYDROCARBONS

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The purpose of this proposed research is to: (1) investigate the potable water supply of the NSTL Mississippi test facility to identify and estimate the organic compounds present and (2) to evaluate the effectiveness of aquatic plants for removal of identified compounds from the water.

We have shown the water hyacinth Eichhornia crassipes (Mart.) Solms will rapidly remove Toxaphene, Mirex, Kepone, and DDT from water. We have also found evidence of dechlorination of Toxaphene in extracts of the leaves of hyacinths grown in aqueous solutions of this pesticide.

The well water will be passed through XAD resin, desorbed with an organic solvent and analyzed for organic compounds by injection in the gas chromatograph with electron capture, the gas chromatograph-mass spectrometer, and liquid chromatograph.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
National Space Technology Lab.

3.0023, THE MATRIX-ISOLATION INFRARED-LASER-RAMAN STUDY OF THE MOLECULAR STRUCTURE OF CHLORINE NITRATE

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The possible depletion of the stratospheric ozone layer by chlorofluorocarbons has been a matter of considerable concern and interest in recent years. The chlorofluorocarbons or freons are chemically inert in the troposphere and may diffuse into the stratosphere and undergo photodissociation to form Cl. The Cl atoms may then react with O_3 to form ClO and possibly catalytically deplete the ozone layer.

It has been suggested that the chemical models of the stratosphere be modified to incorporate the formation and destruction of chlorine nitrate, $ClONO_2$, ClO plus NO_2 plus M yields $ClONO_2$ plus M, $ClONO_2$ plus h nu yields Cl plus NO_3 or O plus ClONO.

A reasonable structure for $ClONO_2$ is one of C_{2v} symmetry with a Cl attached to an oxygen on a symmetric NO_3; however, it has been recently proposed that $ClONO_2$, produced via reaction (1), possibly exists in four isomeric forms, the C_{2V} structure, as ClOONO, OClONO, and OClONO (C_{2V}).

The purpose of this proposed research is to 1) obtain low temperature (10K) infrared and laser-Raman spectra of laboratory synthesized stable $ClONO_2$; 2) determine whether isometric forms of $ClONO_2$ produced from (1) exist and spectroscopically (infrared and laser-Raman) characterize these molecules; and 3) determine qualitatively the relative stabilities of any isomers.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Jet Propulsion Lab.

3.0024, ELECTRON-IMPACT EXCITATION OF MOLECULAR NITROGEN

C.A. Weatherford, State University System of Florida, Florida Agricultural & Mechanical University, School of Science & Technology, Dept. of Chemistry, *Tallahassee, Florida* 32307 (NSG 5307)

A distorted wave procedure is being used to calculate the total and differential, electron-molecular nitrogen impact cross sections, for the elastic and electronic excitation processes. The distorted wave method is a variationally stable technique based on a generalization of the multichannel Kato identity, and a single-center representation of the target is used. However, the scattering equations, which are solved using a non-iterative integral equation algorithm, include only the spherical part of the interaction potential, while the non-spherical part appears in a matrix element sandwiched between the calculated projectile orbitals. The collision energies of primary interest lie between ten and one hundred electron-volts.

A unique development is the use of the computer to generate formulas based on Slater-type orbitals. This is made possible by employment of our recently developed c-matrix and our version of 'computer algebra.'

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

3.0025, HIGH VACUUM-HIGH TEMPERATURE EVAPORATION OF SUPERALLOYS

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OBJECTIVE: To study evaporative characteristics of a number of superalloys at temperatures 700 degrees C, 800 degrees C, 900 degrees C and 1000 degrees C and approximately 10 minus to the 6th power torr. Rates of evaporation of alloy ingredients, and preferential evaporation of the same elements are expected to be learned. Results are to be used to determine the best alloying combination for high temperature applications in outer space,

APPROACH: Four high vacuum and high temperature systems, each at one of the 4 temperatures given above, are loaded with 9 specimens and tested for aging periods from 6 hours to 4600 hours. Weight losses are determined during each successive aging period.

CURRENT PROGRESS: Testing of the first superalloy, Hastelloy X, is almost terminated and plans are currently underway to test Hastelloy S.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0026, ESR STUDIES OF VISCOUS LIQUID CRYSTALS

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The transient response of nematic Phase V (EM Laboratories) and nematic butyl-P-(P-ethoxypenoxycarbonyl)phenyl carbonate (BEPC) to a redirected magnetic field has been explored by EPR and a new EPR linewidth phenomenon accompanying this transient response has been discovered. The spin probes employed in this work were vanadyl acetylacetonate and 2-(14 carboxytetradecyl) 2-ethyl-4,4-dimethyl-3-oxazolidinyloxyl. In all cases studied the transient response for reorientation angles 25 degrees or less leads to an EPR line broadening which relaxes exponentially to the equilibrium value. Below 0 degrees C the activation energy for the relaxation process involving phase V is 14.7 kcal/mole; from 0 degrees C to 25 degrees C the activation energy is 10.1 kcal/mole. In the case of BEPC the activation energies are about 13.5 kcal/mole below 58 degrees C and about 9 kcal/mole above 58 degrees C. In both cases the change in activation energy occurs roughly 5 degrees C above the normal nematic-crystalline transition temperature. Present experimental data show no dependence of the measured relaxation parameters on the nature of the spin probe employed.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0027, SYNCHROTRON RADIATION AS A PROBE OF ATOMIC AND MOLECULAR PROCESSES

R.N. Zare, Stanford University, School of Humanities & Sciences, Dept. of Chemistry, *Stanford, California* 94305 (PHY79-08694)

Research will continue on a study of the interaction of ultra-violet light from a synchrotron radiation source with simple atoms and molecules. New equipment will be installed to obviate the need for any windows between the source and the sample and thus make it possible to use photons of a wider range of wave lengths. Two main topics will be investigated: 1) a study of the dynamics of molecular dissociation; 2) a study of atomic photoionization.

Both studies will address such fundamental problems as the symmetry of the repulsive state responsible for the dissociation process and the lifetime of the excited state.

This research is a continuation of that currently supported under NSF grant PHY77-02252.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

3.0028, ANALYSIS AND EVALUATION OF ADVANCED ROCKET NOZZLE MATERIAL US

J.B. Patton, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN782242)

To increase the basic understanding of the thermomechanical behavior of advanced rocket nozzle materials (e.g. carbon-carbons). Results will lead to increased reliability of advanced strategic propulsion systems. Special attention will be paid to material behavior at high temperature, mechanical property characterization methods, nondestructive test and evaluation methods, failure mechanisms, and improved analytical techniques.

Identify current deficiencies and inadequacies in the thermomechanical characterization of carbon-carbon materials. In conjunction with ONR, a research program will be developed and implemented to increase the basic understanding in critical carbon-carbon materials technology areas. This will be accomplished by reviewing all similar and related work, planning new programs, reviewing proposals, monitoring and evaluating progress of pertinent ONR programs and contracts, providing coordination of similar DOD (NRL, NSWC, RPL, AFML, AFOSR) laboratory efforts and ongoing programs, and keeping our personnel informed about ongoing work and plans.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0029, DAMAGE AND EROSION OF MATERIALS

A.G. Evans, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (DN975217; N00014-79-C-0159)

Carbon-carbon composites (C/C) are prime candidates for use in RV nose cones and launch vehicle rocket nozzles. Ceramics such as Si3N4 are candidate materials for missile engines and domes. The use of these materials in the above applications requires microstructures that are resistant to erosion (material removal). This study has the following three objectives: (1) characterize the deformation processes leading to erosion, (2) determine the microstructural dependence of these deformation processes, (3) develop models of the erosion process.

Carbon-carbon and model (glass fiber-epoxy) materials will be loaded in compression. The deformation processes, such as fiber kink initiation, at defects will be characterized. Displacements at the defects will be analyzed and from these displacements the stresses in the fibers calculated. From these calculations strength/probability models for the fibers will be evaluated. Ceramic materials will be impacted with SiC or quartz particles and indented using standard techniques (Knoop). The resulting material damage will be characterized. the results will be modeled using elastic/plastic stress analysis and fracture mechanics formulations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0030, STUDY OF THE INTERACTION BETWEEN SMALL MOLECULES AND METAL CLUSTERS - A MODEL FOR CATALYSIS

S.E. Novick, Wesleyan University, School of Science in Society, Dept. of Chemistry, *Middleton, Connecticut* 06457 (11260-G5)

It is proposed to investigate structural and dynamical aspects of the metallic surface-hydrocarbon bonding (other compounds will also be tried) so important in heterogeneous catalysis. The experiments that will be carried out in molecular beam high vacuum apparatus consists of producing a weak complex between a small metal cluster and various small molecules via the technique of supersonic expansion. The interactions of various molecules and the surface of the metal cluster serves as the experimental model for the active catalytic site. The techniques to be used to probe these complexes consist of 1) electron excitation and laser excitation to produce fluorescence which will be dispersed and analyzed; 2) mass spectrometric studies; 3) qualitative polarity studies (as a crude structure probe); 4) laser dissociation experiments; and 5) high resolution radio-frequency and microwave spectroscopy as a sensitive structure probe.

SUPPORTED BY American Chemical Society

3.0031, ENVIRONMENTAL EFFECTS IN STRESS CORROSION CRACKING IN ALUMINUM ALLOYS

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The objective of this task is to clarify the role of environmental factors in stress corrosion cracking of aluminum alloys used in naval aircraft and craft.

An experimental program is to be conducted to study the effect of various anions in pitting initiation in aluminum alloys, a study of local solution chemistry in these alloys, and a testing phase to correlate the first two approaches with susceptibility of the alloys to stress corrosion cracking. Standard electrochemical and fracture mechanics techniques are to be used for this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

3.0032, CORROSION IN NATURAL ENVIRONMENTS

J. Kruger, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (3120410)

PROJECT OBJECTIVES: To develop test methods for measuring corrosion of alloys in soil and marine environments and to use those methods to obtain accurate data for engineers designing systems to be used in those environments for pipelines, power cables, aircraft, communications, and structures.

PROJECT APPROACH: Soil, atmospheric and marine test sites are established. Coated, uncoated specimens fabricated from many alloys with and without stress, crevices, coupled with other metals are exposed to the test environments for varying periods. Periodic inspections and electrochemical measurements are made to determine corrosion rates and conditions. New measurement techniques are evaluated. Corrosion data collected at periodic intervals after specimen removal analyzed and published.

PRIOR YEAR ACCOMPLISHMENTS: Piling corrosion monograph completed, 2 papers published, 5 talks presented, 16 new telephone cable systems and cable housing system installed, symposium on power cable corrosion organized, corrosion conditions determined for power cables.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau
of Standards

3.0033, INITIATION OF CRACKS IN LCF OF TITANIUM ALLOY

J.M. Krafft, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980075)

To seek and find basis for interrelating effects of microstructural control on resistance to crack initiations vs propagation due to repeated loading, said basis needed to optimize life of jet engine parts by material selection.

To measure and compare strain-controlled low-cycle-fatigue (LCF) crack initiation with extant data for crack propagation characteristics of the Ti-6Al-4V system. Crack propagation resistance is markedly improved by appropriate microstructural modification but with unknown effect on initiation. The ordinary and cyclic stress-strain curves will be compared to propagation data via TLIM fracture analysis program. The collaboration effort in code 6380 will assess stress-controlled LCF endurance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

3.0034, LASER-INDUCED CHEMISTRY AND ENERGY TRANSFER STUDIES IN SMALL MOLECULES

E. Weitz, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Chemistry, *633 Clark St., Evanston, Illinois* 60201 (CHE79-08501)

This research is in the area of quantum chemistry. A multifaceted program involving laser induced chemistry and vibrational energy transfer studies is planned. Three areas of laser induced chemistry will be investigated. One area deals with the reaction of atoms with triatomic molecules. Reactions have been carefully selected for ease of detection of products as well as the anticipation of significant vibrational acceleration of reactions. In some systems it will be possible to couple laser chemistry with energy transfer studies to yield state resolved reaction cross-sections. Area two deals with bimolecular reaction of stable species where again the systems have been chosen with the anticipation of significant vibrational acceleration of reaction. The final area deals with novel applications of the multiphoton excitation technique to chemical problems. Applications are planned with respect to the concerted or non-concerted nature of elimination reactions, elucidation of reaction mechanism and with regard toward the dynamics of the isomerization process in hexadienes as well as the possible use of infrared multiphoton excitation in the directed synthesis of these isomers. Energy transfer considerations and techniques play an important part in all of these studies. This research represents a continuation of that supported by Foundation grant CHE7610333.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0035, THEORETICAL STUDIES OF ADSORPTION AND RELATED PHENOMENA ON METAL SURFACES

R. Gomer, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (DMR79-07232)

A microscopic model of single particle surface diffusion will be developed to see if abnormally small pre-exponential factors, found experimentally, can be accounted for. It is further planned to study the dynamics of two-dimesional systems with a view to obtaining correlation functions of density fluctuations under conditions where independent particle models of diffusion break down, and to obtain equations of state of adsorbed layers. It is further planned to investigate the electronic structure of composite metal surfaces, consisting of one or more atomic layers of one metal on a substrate with which it does not alloy. Finally, work on field ionizaton of impurity states in semiconductors will be extended to include temperature assisted tunneling.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0036, SYNTHESIS, STRUCTURE, AND MAGNETIC TRANSITIONS IN TRANSITION METAL COMPOUNDS

R.L. Carlin, University of Illinois, Chicago Circle Campus, School of Liberal Arts & Sciences, Dept. of Chemistry, *601 S. Morgan St., Chicago, Illinois* 60680 (DMR79-06119)

The broad goal of this project is to increase understanding of magnetic ordering in solids. Theorists have provided several constructs for different types of magnetic interactions. As a chemist, Professor Carlin is uniquely qualified to prepare, characterize, and measure the properties of the new compounds which are needed in order to test these constructs. Examples are the two- and three-dimensional X-Y magnetic models.

Specific experiments include: (1) low temperature susceptibility and/or specific heat measurements on: (a) transition metal (cobalt, iron, copper, and manganese) pyridine N-oxide complexes, and (b) several amorphous antiferromagnets, including an attempt to construct a spin glass in a nonmetallic system, and, (2) determination of magnetic phase diagrams below 1K.

First year of a three-year continuing grant. Continuation of work supported under Grant No. DMR76-18963.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

3.0037, APPLICATIONS OF ELECTRON MICROSCOPY IN MATERIALS SCIENCE

H.L. Fraser, University of Illinois, Urbana Champaign Campus, Materials Research Lab., *Urbana, Illinois* 61801

Development and application of analytical and transmission electron microscopy techniques to determine morphology, microstructure, crystal and electronic structure, and microchemistry of metallic alloys is under way. Applications include the omega phase transformation in Zr-Nb alloys, iodine embrittlement in Zr alloys, the alpha-beta interface in Ti-Al-V alloys, and precipitation in Nb-Ti-C alloys. (ERDA-77-123)

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

3.0038, ULTRASONICALLY STIMULATED ACOUSTIC EMISSION

D.N. Beshers, Columbia University, School of Mines, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (DMR77-05214 A01)

This is a continuation of studies of dynamic plasticity within solid materials by analysis of the harmonic spectrum generated by ultrasonic stimulation. The information derived from the spectrum analysis is correlated with mechanical property data and metallographic determination of the microstructure. The method, developed studying brass, will be extended to several more complex single-phase and two-phase body-centered cubic and face-centered cubic alloys. The results obtained will be used to develop a quantitative model of dynamic events which occur during the plastic deformation of metallic materials. This is a renewal of NSF grant DMR75-03236.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0039, THEORETICAL STUDIES IN CHEMICAL PHYSICS

D.R. Herrick, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Chemistry, *1472 Kincaid St., Eugene, Oregon* 97401 (CHE79-09500)

This grant supports research under the Quantum Chemistry Program to study symmetry effects of electronic states in atoms and molecules. When the motions of electrons are highly correlated, the usual classification scheme for ground or excited states becomes inadequate, leading to apparent anomalies and difficulty in the interpretation of experimental data. Professor Herrick's research is essentially concerned with clarifying this situation by group theoretical analysis of the interaction between electron pairs. Three related areas involving strong mixing effects and autoionization will be investigated: (1) Multiply-excited states and few-body correlations, and the extent to which near-degeneracy mixings and new energy level clustering effects are governed by Lie algebras, including doubly-excited states, leading to the two-electron photodetachment threshold of negative ions; (2) High-Rydberg states, especially angular momentum transfer mechanisms and strong state-mixing by electron collisons, the Stark effect, and atomic diamagnetism; (3) New computational approaches to complex energy variational methods and resonances, including effects of vibrationally excited diatomic Rydberg states and narrow-width transmission models for quasi-one-dimensional semiconductors. An objective of part of the research is to help provide more efficient design of semiconductor devices.

This is a renewal of research currently supported by NSF grant CHE7610332 to the University of Oregon at Eugene.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0040, ELECTRONIC STRUCTURE OF SUBSTOICHIOMETRIC TRANSITION METAL OXIDES

J.W. Rabalais, University of Houston, School of Natural Sciences & Mathematics, Dept. of Chemistry, *3801 Cullen Blvd., Houston, Texas* 77004 (E-656)

The phenomena of photochromism and electrochromism in amorphous transition metal oxide films of WO3, MoO3, and V2O5 have been investigated by X-ray and UV photoelectron spectroscopy. A sandwich configured electochromic cell is described which allows reversible coloration/bleaching of the films. Results indicate that upon coloration, reduced state species of the metal ions are produced and that electrons occupy empty metal *d* bands near the Fermi level.

Ion beam studies of the reactions of nitrogen and nitric oxide with surfaces of carbonaceous materials have been investigated by X-ray and UV photoelectron spectroscopy (XPS and UPS), secondary ion mass spectrometry (SIMS), and flash desorption mass spectrometry. Reaction of N and O with graphite produces two products, a cyanide- or oxide-type compound and intersitial N or O atoms between the layers of rings or at defect sites. Reaction of N with diamond or teflon produces only a cyanide-type compound. Reaction of N with Si and Ge and their oxides produces nonstoichiometric nitrides which are similar to *Si3N4* and *Ge3N4*. *SIMS* experiments on alkali halides have shown the clusters of the type MnXn-1 where M equals Li, Na, K, Cs and X equals F, Cl, Br, I are very stable in the vapor phase.

SUPPORTED BY Robert A. Welch Foundation

3.0041, ELECTRON SPECTROSCOPY OF SEMICONDUCTOR HETEROJUNCTION INTERFACES

M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DN775535; N00014-77-C-0474)

The operational properties of solid state electron devices used in Navy electronic systems, are often dominated by the electronic effects occuring at various solid surfaces and solid-solid interfaces. understanding and controlling the surface effects is essential to improving performance and reliability.

Using surface analysis techniques such as Auger spectroscopy, ultraviolet photoemission spectroscopy, x-ray photoemission spectroscopy, and energy loss spectroscopy, the investigator will probe the local electronic properties of surface atoms. These atoms may represent the host material, absorbed impurities, or atoms of an adjacent host material such as occurs in the semiconductor-semiconductor heterojunction. Determination of the local density of states at each atom will permit evaluation of the effects of impurities or surface states on the overall electronic nature of the surface. Of particular interest is the nature of the energy discontinunity which appears at the heterojunction interface and the changes in local density of states as a result of surface disorder and oxidation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, ATMOSPHERIC EFFECTS ON COHERENT LASER SYSTEMS

S.S. Murty, Alabama Agricultural & Mechanical University, School of Technology, Dept. of Engineering Technology, *Normal, Alabama* 35762 (NSG 8037)

The objectives of this work is to investigate the effects of atmosphere on the performance of the CO2 laser Doppler systems and to explore the application of the differential absorption technique of detecting gaseous constituents using NASA-MSFC system. The approach is mainly theoretical. In addition, we will be gathering experimental data on the behavior of structure constant CN of the atmospheric refractive turbulence. The analysis of the finite beam effects on the signal-to-noise ratio has been completed and current effort is on developing a computer program to evaluate the finite beam effects.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0002, PSEUDONOISE TEST TECHNIQUE FOR COMMUNICATIONS CHANNEL EVALUATION

G.D. Weathers, Alabama Agricultural & Mechanical University, School of Technology, Dept. of Electrical & Electronics Engineering Technology, *Normal, Alabama* 35762 (NAS 9-14770)

The effort includes a detailed study of the application of RMS distortion testing using pseudonoise to communications channels where performance is traditionally based to some extent upon subjective factors. These channels include television and voice communications. The results of this study will be applied to the development of communication system testing techniques which will extend the usefulness of a pseudonoise test-set.

The project also includes a design study of alternate methods for non-real-time testing of data handling systems that include a record-playback process, and construction of breadboards to demonstrate the most promising techniques.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0003, THERMAL ANALYSIS OF COAL

P.I. Gold, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NSG 7263)

The purpose of this study is to continue the program of experimental thermal analysis of coal to provide quantitative data suitable for the development of thermal design criteria for high-pressure coal-feeding processes.

Differential scanning calorimetry studies demonstrated the occurrence of exothermic transitions in or near the plastic region superimposed upon the major endothermic process associated with the production of volatiles in the range of 300-500 degrees C, when coal is heated in an inert gas.

Thermogravimetric analyses performed under the same conditions indicated a close relationship between the temperature of maximum volatization and the temperature at which the exotherm is observed.

Effort is currently underway to develop kinetic parameters for the weight loss process and quantitatively determine the enthalpy changes during pyrolysis.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of External Relations

4.0004, DEVELOPMENT OF A DIRECT CONTACT HEAT EXCHANGER FOR APPLICATIONS IN POWER GENERATION SYSTEMS UTILIZING GEOTHERMAL BRINES

R. Manvi, California State University & Colleges, California State University, Los Angeles Campus, School of Engineering, Dept. of Mechanical Engineering, *Los Angeles, California* 90032 (NASW 3257)

The objectives of the study are: Experimental investigation of Direct Contact Heat Transfer mechanism in which a hot water jet collides with a Freon 113 liquid jet. Freon 113 is basically immiscible in water. The liquid jets would impinge at various angles, and with differing momenta. Development of heat transfer correlations, comparison of this study's heat transfer data with other direct contact heat exchanger concepts.

The experimental setup to conduct heat transfer experiments has been assembled and leak tested. Heat Transfer data gathering is underway and during the final period of this study, heat transfer correlations will be developed and assessed.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of External Relations

4.0005, INVESTIGATION OF AN AUTOMATIC ELECTRONIC CONTROLLER FOR USE IN HUMAN THERMAL REGULATION WITH A LIQUID COOLED GARMENT

J.H. Kurzweil, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Electrical Engineering, *Washington Sq., San Jose, California* 95192 (NCA 2-675904)

The need for automation of human thermoregulation using a liquid cooled garment in the artificial environment of a space suit is shown. The possible control methods are explored and an approach suitable for use in an operational extravehicular protective system is selected. The proposed research will lead to fabrication and refinement of a breadboard, microprocessor based controller that will maintain thermal equilbrium for a wide range of exercise rates and thermal environments.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

4.0006, COMMUNICATIONS SYSTEM ANALYSIS OF ADVANCED MANNED SPACE FLIGHT

D.L. Schilling, City University of New York, City College, School of Engineering, Dept. of Electrical Engineering, *Convent Ave. & 138th St., New York, New York* 10031 (NAS 9-13940)

Hardware considerations frequently dictate the use of 'conventional' analog processing and transmission techniques for communications channels such as television. Analog FM with discriminator detection at the receiving terminal is frequently the choice and has been used exclusively in manned spaceflight systems.

With the advent of communications relay satellites, dramatic increases in communications coverage are possible, but this increased coverage is not without penalty. The receiving terminal for a television signal originated at and transmitted from the manned spacecraft will now be at a much greater distance and will have greatly reduced capabilities. More efficient signal processing and transmission techniques become of interest, therefore, in an attempt to reduce the hardware required at the manned spaceflight terminal to provide acceptable communications.

Digital transmission systems offer several potential advantages over analog transmission systems, including increased link efficiency, lighter weight, higher reliability, reduced prime requirements, and greatly increased ease of multiplexing with other signals in digital form. An efficient source encoding technique, to reduce the transmitted bit rate, used in conjunction with an efficient channel encoding technique, can provide very real and significant performance advantages over analog transmission systems.

Previous efforts in this area have led to the development of a small, low-power, efficient ADM for encoding television signals. However, current ADM design results in periods of operation resulting in steady-state, repetitive ADM encoder outputs of the form--11001100--corresponding to a non-varying input signal. It is the intent of this research to provide for an analysis of the occurrence of the 1100 pattern, determine the possible data rate reduction resulting from the removal of the 1100 pattern, and estimate the equipment necessary to perform such removal.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0007, AN ADAPTIVE LEARNING CONTROL SYSTEM FOR LARGE FLEXIBLE SPACE STRUCTURES

F. Thau, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NAG 1-6)

ABSTRACT. The purpose of the research is to study the application of adaptive/learning control systems for large, flexible space structures. Techniques that have been developed for the control of aircraft despite changing operating characteristics are used to develop a learning control system for a multi-configuration flexible space vehicle. Statistical decision theory is used to design sensor and actuator redundancy management subsystem algorithms and to develop a configuration identification subsystem to be used with a learning algorithm subsystem and a memory and control process subsystem.

An important feature of this learning approach is that adaptive gain adjustments can be achieved without prestoring large blocks of parameter data and without the need for 'dither' signal inputs which will be suppressed during operations for which they are not compatible.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0008, INVESTIGATIONS OF FREESTREAM NOISE IN SUPERSONIC NOZZLES (ABBREV)

M.R. Schopper, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NAS 1-15877)

It is well known that the noise radiated from turbulent nozzle boundary layers affects boundary layer transition on wind tunnel models. In the current research effort the noise-transition problem is being studied. A theoretical study of one aspect of the noise-laminar layer interaction will be completed and published as a NASA Contractor Report. Some of this work has appeared in AIAA Paper 79-1523. Previous measurements in a Mach 5 rapid-expansion nozzle have shown that the acoustic disturbance levels are low in the leading portion of the test section rhombus. An investigation of boundary layer transition on a slender cone in this Mach 5 nozzle is currently underway to see if transition is delayed as a result of the low noise levels. It is expected that a Mach 3 rapid-expansion nozzle will become operational in early 1980 and that cone transition results will also be obtained in this new facility.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0009, THE INVESTIGATION OF MICROPROCESSORS AS MASS STORAGE CONTROLLERS FOR FLIGHT APPLICATIONS

A.K. Trehan, Hampton Inst., Graduate School, Dept. of Electrical Engineering & Computer Science, *Hampton, Virginia* 23368 (NSG 1294)

One of the major problems in the data systems for inflight applications is the mass storage of data at medium and high speeds. The massive flight data is usually stored on some mass storage device like a tape or a disc with or without pre-processing. With the development of microprocessors, it seems feasible and cost effective to use them as controllers for the acquisition of in-flight data.

Hampton Institute has investigated the use of microprocessors and floppy discs for use as in-flight mass storage devices at medium and high speeds for use with the ongoing experiments of the FID at Langley Research Center.

Due to the significant advances made recently in the monolithic image sensor field, there are sensors available that combine the advantages of charge coupled devices and custom designed photodiode arrays. One such device, a RETICON CCPD-1728 as well as a FAIRCHILD CCD121H has been interfaced with the HP 2100 for complete evaluation.

In conjunction with the interface effort, HI has also investigated the possibility of using recent developments in the bit slice processors so as to handle each pixel of data independent of any other pixel.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0010, THE INVESTIGATION OF MICROPROCESSORS FOR USE AS CONTROLLERS FOR TUNABLE DIODE LASERS

A.K. Trehan, Hampton Inst., Graduate School, Dept. of Electrical Engineering & Computer Science, *Hampton, Virginia* 23368 (NSG 1552)

The Laser Heterodyne Spectrometer (LHS) currently being developed at Langley Research Center will provide the capability to measure atmospheric pollutants with a specificity unrealizable in the past.

To achieve this high degree of accuracy, an exceedingly complex instrumentation is required. The Tunable Diode Laser (TDL), a solid state device is a prime contender for the local oscillator in the LHS. However TDL exhibits a considerable variability and hysterisis in its wavelength stability and control.

Hampton Institute is investigating the design of a microprocessor based controller for a TDL system. The investigation includes a study of using off-the-shelf assemblies in the fabrication process and development of the system software. The initial design of the controller has been accomplished and presently a number of methods are being analyzed and reviewed for the wavelength identification. At present a gas cell using a known gas shows promise.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0011, RADIATIVE TRANSFER MODEL FOR REMOTE SENSING OF LASER-INDUCED FLUORESCENCE OF PHYTOPLANKTON IN NON-HOMOGENEOUS TURBID WATERS

D.D. Venable, Hampton Inst., Graduate School, *Hampton, Virginia* 23368 (NCC 1-11)

The purpose of this study is to characterize phytoplankton using remotely sensed optical data from laser induced fluorescence of chlorophyll a. A radiative transfer computer model is being developed to characterize the total flux and angular distribution of photons when laser radiation is incident on turbid water that contains a non-homogeneous suspension of inorganic sediments and phytoplankton. This radiative transfer model is based on the Monte Carlo technique. The computer model assumes that the aquatic medium can be represented by a stratified concentration profile and that appropriate optical parameters can be defined for each layer. The present research efforts include comparison of the predicted results with published data. In addition, efforts are being made to minimize the required computer resources and run time.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0012, THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES I, II, AND III

P.M. Bainum, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 1414)

Attitude control techniques for the pointing and stabilization of very large, inherently flexible spacecraft systems are being investigated in this research. First the attitude dynamics and control of a long, homogeneous flexible beam whose center of mass is assumed to follow a circular orbit have been treated. In the initial phase, first-order effects of gravity-gradient are included, whereas external perturbations and related orbital station keeping maneuvers are ignored. Three mathematical models describing the system's rotations and deflections within the orbital plan have been developed--one model, which treats the beam as a number of discretized mass particles connected by massless links, and two continuum-type models. The natural (uncontrolled) dynamics of this system have been simulated. The concept of distributed modal control, which provides a means for controlling a particular system mode independently of all other modes, has been examined, along with other types of control laws including an application of optimal control theory. The effect of varying the number of modes in our model as well as the number and location of control devices is being examined, analytically, where possible, and numerically for general cases.

In the latter phases of the study, three dimensional mathematical models of beams, plates, and antenna-like shell structures are being treated, following the approach described above for the two-dimensional beam; control of the continuum model of the plate, and shell models will be treated. In addition, it is planned to consider different ways of selecting actuator control laws and also the effects of sensor noise and model uncertainty.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0013, THEORETICAL EVALUATION OF LINEAR KALMAN FILTERING TECHNIQUES FOR ADVANCED MISSION STATE DETERMINATION

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 9010)

Theoretical Evaluation of Linear Kalman Filtering Techniques for Advanced Mission State Determination.

Most practical filtering problems involve delay in the state variables due to the time taken in the transmission of signals. The delayed state space equation is of the form: XK plus 1 equals AXK plus B XK-l plus C UK; YK equals D XK plus VK where l greater than or equal to 1 is the delay. UK, VK are white Gaussian noises, and the matrices A,D,C,D are of appropriate dimensions. In case of delayed state space model degeneracy occurs and plays an important role.

The system XK plus 1 equals A XK plus B XK-l; YK equals D XK is said to be degenerate if YK is identical to O, K more than or equal to n, where n is a positive integer. Constructions of degenerate systems, i.e., given D,A, l, to find B such that YK is identical to O, K more than or equal to n is an important problem. Constructions of degenerate problems containing all possible free parameters are being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0014, PERFORMANCE OF NON-COHERENT CODE TRACKING LOOPS

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Global position satellite system (GPS) is a three-dimensional radionavigation system for estimating the position of moving vehicle very accurately. The GPS receiver consists of two coupled loops, Doppler-tracking (costas loop) loop and delay-tracking loop (code loop). For slow-moving vehicles the Doppler can be assumed to be constant and the loops can be decoupled, and inexpensive receivers can be operated on the above assumption. Here the delay-tracking loop (code loop) is analyzed analytically in the linear region and simulated in HP 21 MX computer in the linear and non-linear regions for different tracking loop filters. Z transform is used in the analysis.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0015, TRACKING OF DELAY/DOPPLER LOOPS OF REFSAT RECEIVER

A.K. Choudhury, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAS5-24251)

Global position satellite system (GPS) is a three-dimensional radionavigation system for estimating position and velocity of vehicles accurately. Here the acquisition and tracking properties of Doppler/delay loops suitable for REFSAT AIDING GPS loops are analyzed and compared with simulated results.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0016, THE 1980 NASA-ASEE SUMMER FACULTY FELLOWSHIPS PROGRAM (AERONAUTICS AND SPACE RESEARCH) AT THE NASA GODDARD SPACE FLIGHT CENTER, GREENBELT, MD

D. Fan, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NGT 09-011-060)

The objectives of the NASA-ASEE Summer Faculty Fellowships Program (Aeronautics and Space Research) are: (1) to further the professional knowledge of qualified engineering and science faculty members; (2) to stimulate an exchange of ideas between participants and NASA; (3) to enrich and refresh the research and teaching activities of participants' institutions and to contribute to the research objectives of the NASA centers.

Thirty-two college or university faculty members from major engineering and science disciplines will receive Fellowships to participate in the ten-week program at the NASA Goddard Space Flight Center (GSFC) during the summer of 1980. The program consists of two parts: research (90% of total time) and education (10% of total time). In cooperation with GSFC Colleague, a Faculty Fellow will pursue independent research on a selected topic of mutual interest. The research program thus provides Faculty Fellows with unique opportunities to contribute to ongoing projects at GSFC. The educational program will include a short course and weekly seminars by invited lecturers on topics of general interest. Also tours of NASA facilities will be conducted.

Research opportunities in the areas of communications/computers, engineering, space sciences, earth resources/observations, atmospheric sciences/geophysics are available at GSFC.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Office of External Relations

4.0017, CHARACTERIZATION OF LOW INTENSITY X-RAY IMAGING DEVICES (LIXISCOPE)

G.A. Ferguson, Howard University, School of Engineering, Dept. of Mechanical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5268)

A low intensity x-ray imaging scope (LIXISCOPE), developed by NASA, is being characterized using radiation from an electrically excited source. The optimum energy spectrum recommended for several categories of specimen being analyzed (i.e. medical specimen, industrial specimen, etc.) will be determined. The utility of the LIXISCOPE in medical applications will be investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0018, GRADUATE RESEARCH PROGRAM IN ADVANCED AEROSPACE STRUCTURES

I.W. Jones, Howard University, School of Engineering, Dept. of Civil Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 1320)

The present research effort in this program is a study of various types of foldable elastic tubes for use as structural members or hinges in large space structures.

The in-orbit construction and/or deployment of large space structures (platforms, antennas, solar cell arrays, etc.) will become technically feasible with the advent of the Space Shuttle. One of the basic concepts under consideration for the creation of these structures is to construct sub-assembly structural systems on the ground, packaged to fit within the vehicle, place them in orbit and deploy them without the use of external energy. The underlying problem of developing a lightweight system that can be folded into a small volume, high density mass, and deployed utilizing only the stored strain energy is being studied under this grant.

To date, a series of test specimens of various geometries, and a special purpose testing machine have been designed and constructed. Unfolding tests are being conducted to determine the workability of the specimens and the strain energy released by each.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0019, FEASIBILITY STUDY OF USING FET TO MEASURE ELECTRIC FIELD STRENGTH

Y. Wang, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (KSC 79-11)

The objective of this project is to build an electric field measurement sensor with no moving parts. The electric field to be measured is the quasi static fields from electrified storm clouds.

The approach is to make use of field effect transistors as the sensing device. They are small and use very little electrical power. If mounted about a sphere and raised above ground, the direction as well as the magnitude of the field can be determined.

The first task is to determine the difference in the electric field form factor for a smooth sphere and for a sphere with the transistors mounted on it.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
John F. Kennedy Space Center

4.0020, DYNAMIC CHARACTERISTICS OF LINEAR HYDROSTATIC GAS BEARINGS

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Linear hydrostatic gas bearings have been proposed for use in mechanical coolers for space applications. The purpose of the proposed research is to study the static and dynamic characteristics of such systems. The principal problem to be addressed is the angular forced vibration of a statically loaded, inherently compensated, hydrostatic journal bearing due to oscillating external pressure. The solution to this problem has been identified as critical to the analytical determination of the load-carrying capacity of a bearing in a candidate cooler design. Consideration will also be given to radial forced vibration and to free vibration of this type of bearing.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0021, CALIBRATION OF THE QUARTZ CRYSTAL MICRO-BALANCE CASCADE IMPACTOR USING THE BERGLUND-LIU MONODISPERSE AEROSOL GENERATOR (ABBREV)

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OBJECTIVE: The objective of this research is to calibrate the Quartz Crystal Microbalance (QCM) and determine its response to particle size and mass concentration.

INSTRUMENT DESCRIPTION: The QCM is the most promising of the instruments capable of giving real-time data of aerosols characteristics from stratospheric and surface sampling. It is a ten stage cascade impactor that collects pollutants aerodynamically according to their size distribution and density. The instrument is flown on the NASA-U-2, which flies up to an altitude of 65,000 feet, the NCAR Saberliner, which flies up to 40,000 feet, and the NASA-P-3, which flies up to 25,000 feet, for sampling atmospheric aerosols.

APPROACH: The Berglund-Liu Aerosol Generator will be used to generate particles of known size and mass density and introduced into the QCM. The instrument will be checked for its response to aerosols of known sizes and mass density. The Laboratory Values will be compared to the Calculated Values that are based on the design parameters of the instrument.

PROGRESS: Particles from 0.312 up to 2.020 microns were generated using the Nebulizer method employing Latex spheres and good results were achieved. Efforts are underway to generate larger aerosols for continued research.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0022, THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROGRAPHIC FILM

E.C. Hammond, Morgan State University, Graduate School, Dept. of Science Education, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NSG 5074)

The purpose of this project is to develop, evaluate, and utilize densitometric techniques and procedures for the determination of the relative and absolute characteristics of standard and special spectroscopic films and plates in the infrared, visible, and ultra-violet spectral-region. IIaO spectroscopic film was irradiated by neutrons from a neutron howitzer, producing 106 neutrons per steradians. The film placed in the metal canister and irradiated with neutrons exhibited higher density readings, than those films placed in the plastic canister. Using a weak gamma-source, the middle density patterns of the film tended to display some separatioh, compared to the controls. The exposure of IIaO film to a beta-source showed dramatic increases in the densities in the lighter density patterns as well as in the darker densities patterns. We have subjected the IIaO film to various experiments involving soaking and agitating the film, as a function of standard times and temperatures. There are dramatic density changes, depending upon length of time for soaking and the agitation patterns used. Exposing the film to an electric field produced dramatic changes in the densitometric readings of the patterns. Substantial density changes resulted when IIaO films were exposed to liquid nitrogen temperatures. Our initial studies on the aging processes of IIao film attempted to quantify the effects of ambient light and heat, which together produced density increases over a nine month period. Studies have been conducted using a densitometric comparison versus different solvents, including distilled water made at Goddard, tap water from the City of Baltimore and distilled water produced at Morgan. The distilled water processing solutions showed greater stability as a function of time, while the city tap water produced substantial increases in the density readings across the entire range of the photographic patterns on the IIaO.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0023, THE INVESTIGATION, IDENTIFICATION, ANALYSIS, AND INTERPRETATION OF NEW POSSIBILITIES IN TRANSFER TECHNOLOGY AT GODDARD SPACE FLIGHT CENTER

J.H. Taylor, Morgan State University, School of Arts & Sciences, Dept. of Physics, *Baltimore, Maryland* 21212 (J-23558; NAS 5-23558)

The objective of this project is to assist Donald Friedman, Goddard's technology utilization officer, in assessing Goddard's technology, inventions/scientific capability potential for possible transfer to the public sector.

This year with the permission of Dr. Yin, I entered the Lixiscope in the Industrial Research Corporation's program to honor the 100 most significant inventions of the year. We were successful in winning an award. This is the first time Goddard has participated in this program. We anticipate continuing participation.

Currently I am involved in a project with the Hopkins Wilmer Eye Clinic which deals with Goddard's expertise in image enhancement. Preliminary work on this project far exceeds the expectations of the doctors at Hopkins. We feel this will result in an excellent transfer of Goddard's expertise to the medical community.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0024, A LABORATORY STUDY OF THE DIFFUSE REFLECTANCE SPECTRA OF FROSTS AND MINERALS OCCURRING ON ASTRONOMICAL OBJECTS

F.M. Glaser, Pan American University, School of Science & Math., Dept. of Physical Sciences, *Edinburg, Texas* 78539 (NSG 9070)

Measurements of the diffuse reflectance of single-component and polycomponent frosts at a variety of temperatures have been carried out over a wide spectral region. Frosts composed of water, ammonia, carbon dioxide, and hydrogen sulfide have been studied in detail. In some cases, features in the spectra are temperature dependent and can be used as a remote thermometer when the frost is observed on a remote astronomical object, such as a planetary satellite or atmosphereless planet. Spectra of a few mineral powders and frost-covered mineral surfaces have also been obtained. These results simulate the 'dirty snow' seen in the polar regions of Mars and are useful in interpreting the spectrophotometric data of planets, asteroids, and satellites.

The study of the effects of radiation on these materials is continuing. Far ultraviolet photons, electrons, protons, and other charged particles can initiate a variety of chemical and physical reactions in the surface layers of solids. The presence of reaction products can be detected as changes in the reflectance spectrum and perhaps identification of some of the product species can be made from this data alone. In any case, many astronomical objects are subject to ionizing radiation of differing extent. Such measurements are of particular interest in the case of Galilean satellites as they are subjected to the intense radiation trapped in Jupiter's magnetosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0025, EXTENSION OF CANOPY REFLECTANCE TO LANDSAT AND LIGHT INTERCEPTION WITHIN A CANOPY

E.W. Le Master, Pan American University, Graduate School, Dept. of Physical Sciences, *Edinburg, Texas* 78539 (NSG 9033)

So that field reflectance spectra and vegetative canopy reflectance models can be coupled directly to LANDSAT multispectral scanner (MSS) data, a model has been developed for taking light reflected from a vegetative canopy, passing it through a standard atmosphere, and converting it to MSS digital counts. This model will be tested directly for several crops and bare soil using LANDSAT overpass data and field reflectance spectra. The data collected from these sites will also be used to test several theoretical results derived during the last grant period. It was found that the concepts of infinite reflectance could also be applied to LANDSAT data, yielding unique points of infinite green reflectance for cotton, wheat, and grain sorghum. Such points can be used for both crop discrimination and the calculation of leaf area index.

An array of silicon light detectors constructed in the present grant period will be used to measure the visible (400-700 nm) and infrared (700-1100 nm) radiation fluxes inside a vegetative canopy. The results will be used to test the light absorption model developed by the investigators and to further our understanding of the model depth concept.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0026, STATE VECTOR UPDATE FILTER FOR AUTO-LAND PORTION OF THE SHUTTLE LANDING

G.S. Grewal, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Electrical Engineering, *Baton Rouge, Louisiana* 70813 (NSG 9030)

The autoland portion of the shuttle landing, which starts at approximately 12,000 to 2,000 feet altitude, requires a high-rate state vector update. The processing of the external navigation aid data at a rate greater than two seconds would require a replacement of the sophisticated Kalman filter with a faster filter like the complementary filter used by Sperry on CV990 autoland project, or a modified suboptimal version of the general Kalman filter.

The state vector of the general Kalman filter, as used in the shuttle, has 12 components; three for the position, three for the velocity, three for the IMU platform alignment errors, and three for the measurement biases. In the land phase the dimension of the state vector is reduced to six; three for the position and three for the velocity of the shuttle. Experience has shown that the switch-over from the Kalman to the complementary filter is not very successful, especially as far as the velocity component of the state vector is concerned. The bounds on the error between the Kalman and the complementary filter have been derived, assuming no IMU misalignment and measure biases, but the errors from the experimental results exceed the analytic bounds. This indicates that the IMU misalignment and the measurement biases cannot be ignored in the complementary filter, i.e., the complementary filter should be expanded from six to twelve states. This would entail extra computation time for the complementary filter, thus diluting its value.

Research has been completed and remaining effort will be concentrated on documentation and evaluation of results.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0027, IN VITRO EXPERIMENTAL VALIDATION OF SOME LEFT VENTRICULAR ANALYTICAL MODELS

G. Ray, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NSG 2041)

A computer assisted methodology has been developed to analyze the sequential motion of the human left ventricular (LV) chamber to determine the (i) regional distribution of the constitutive properties of the passive myocardium during diastole and (ii) the distribution of the blood pressure inside the LV chamber during systole. Both of these parameters provided a new and powerful intrinsic index of the LV contractility and the regional location of the myocardial pathology. Several human and canine angiocardiographic data were exercised and analyzed by this method which we have described as 'Mechanocardiography'.

In order to determine the accuracy of these computer models we have preformed in vitro experiments with LV chambers made of Silastic casts. The pulsating physiological flow was simulated in a mock circulatory device. The wall motion was recorded with a high speed (hy-cam) camera and the continuous variation of the chamber pressure was monitored. These served as input data to the finite element computer model of the LV chamber. Good correlation between the model predicted results and the experimental findings were observed. Currently the results are undergoing further statistical evaluation.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

4.0028, ATOMIC OXYGEN STIMULATED OUTGASSING EXPERIMENT FOR THE LONG DURATION EXPOSURE FACILITY (LDEF) PHASE 1, 2, AND 3 (OPTION)

R.L. Scott, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NAS 1-15335)

Select thermal control surfaces will be exposed to the atomic oxygen in the near orbit. Passive collecting samples wwll collect any induced outgassing resulting from the oxygen impingement. The optical condition of the passive samples will be measured using a ground based integrating sphere reflectometer and a directional reflectometer. This experiment makes it possible to determine if the atomic oxygen was a major factor in observed but unexplained Skylab contamination.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0029, ENVIRONMENTAL AND GROWTH MEASUREMENTS IN WHEAT AND SORGHUM FIELDS AND THEIR CORRELATION WITH INFRA-RED RADIATION TOWARDS PREDICTING YIELDS

E.A. Brams, Texas A & M University, Prairie View A & M University, School of Agriculture, Dept. of Electrical Engineering, *Prairie View, Texas* 77445 (NSG 9006)

The primary objectives of the research are to acquire ground measurements of environmental and growth parameters in a field containing a rotation of winter wheat followed by grain sorghum throughout the growth season in the Texas Coastal Prairie, and to analyze the measurements to find relationships that assess crop vigor from which experienced agronomists could predict yield levels.

An experimental field of level terrain with uniform soil has been planted and harvested since 1975. Environmental and growth measurements continue to be taken during each cropping season. Ten stations will be established in each field, representing ten replications to measure select variables taken daily at 1500 hours. A total of 26 variables will be measured, including infra-red radiation, temperatures, moisture, wind, and plant growth factors. Data groupings and statistical analysis will be performed, with the objective of identifying relationships among the 25 variables considered the independent variable.

It is assumed that air temperatures of the grain canopy, soil moisture at 0-6 cm depths, soil temperatures at 2-6 cm, and solar energy absorption will have a profound and direct influence on crop performance during the growing season. Measurements of the four parameters will be related to infra-red measurements towards developing an assessment of crop vigor that can be related, in turn to a proportionate factor of maximal yield at harvest.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

4.0030, PERMEABILITY OF POLYMERIC MATERIALS TO CONDENSABLE GASES AND ORGANIC LIQUIDS

I.G. Dillon, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (KSC 70 10)

The effects of certain penetrants on barriers of chemical protective clothing are being examined in terms of the permeability of the clothing to these penetrants. Clothing material being evaluated includes Neoprene, Polyurethane, Polyvinyl alcohol, and Butyl coated Nomex. Penetrants of interest are Dimethyl Formamide, Hexane, Toluene, and NO2.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0031, INVESTIGATION OF ELECTRICAL BREAKDOWN CHARACTERISTICS AND STABILITY OF INSULATING MATERIALS USED ON SOLAR CELLS

C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8038)

The main objective of this investigation is to study and evaluate the extent of degradation of the insulating materials used on Solar cells mounted on the spacecraft. The degradation occurs due to the effect of space plasma and plasma initiated discharges in the presence of high electric fields. Extensive test rigs and measuring equipment have been developed, calibrated and checked to measure the changes in the dielectric properties of the insulating materials. Accurate tests and measurements will be conducted to measure the changes in the dielectric constant, surface resistivity, volume resistivity and the dissipation factor of the insulating materials. These investigations are expected to result in a realistic evaluation of the quality and stability of the insulating materials, thereby contributing to the development of more efficient and reliable solar cell power systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0032, INVESTIGATION OF DEGRADATION PROCESS OF INSULATING MATERIALS

C.V. Doreswamy, Tuskegee Inst., School of Engineering, Dept. of Electrical Engineering, *Tuskegee Institute, Alabama* 36088

The primary objective of the proposed investigation is to study the effect thermal stresses, high electric field and plasma on the electrical insulating materials. Basic research looking into the fundamental processes of insulation degradation and stability will be carried out. The aspects identified for the intensive experimental and theoretical study are the nature of surface discharges, dielectric loss mechanisms and changes in the surface and volume insulating properties due to thermal cycling. It is hoped that the results of this investigation will lead to the development of useful guidelines and evaluation methods for the design of more efficient and reliable electrical systems, and solar cell arrays.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0033, AN IMPROVED COMPUTER MODEL FOR PREDICTION OF AXIAL GAS TURBINE PERFORMANCE LOSSES

R.M. Jenkins, Tuskegee Inst., Graduate School, *Tuskegee Institute, Alabama* 36088 (NSG 3295)

The program objective is to develop a comprehensive, reliable computer model for prediction of aerodynamic performance losses in axial gas turbines, utilizing a minimum of program input variables. Blade profile losses are to be related to approximate blade geometries through use of the Stanitz blade generation technique. Endwall, tip leakage, and secondary flow losses will be accounted for by existing empirical correlations. Particular emphasis is to be placed on boundary layer growth and separation phenomena within a blade row.

Future work will concentrate on refinement of the various program subsystems; it is also intended to eventually extend the analysis to radial turbine configurations.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0034, ANALYTICAL INVESTIGATION OF THE HEAT-PIPE RADIATOR AS A SPACECRAFT HEAT REJECTION SYSTEM

J.P. Sellers, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (NAS 9-13844)

As a result of NASA-sponsored feasibility and prototype heat-pipe radiator testing, valuable experimental data have been accumulated. In this study the analysis, interpretation and documentation of these data will be continued. Computer models, either those written previously for NASA, or new ones when needed, will be used to complete the analysis.

Because of the current interest in the fluid header concept and its demonstrated high performance, particular emphasis is placed upon analysis of data from the JSC prototype panel vacuum tests. All single-panel data obtained to date have been analyzed and the results reported; 3-panel results are being finalized, and a summary report will be prepared.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

4.0035, INVESTIGATION OF ABSORBERS AND RADIATORS FOR SOLAR POWER SYSTEMS

J.P. Sellers, Tuskegee Inst., School of Engineering, Dept. of Mechanical Engineering, *Tuskegee Institute, Alabama* 36088 (NSG 8054)

A high efficiency absorber is essental for the economical operation of thermal solar space power systems. It was established in earlier theoretical studies that the reradiation losses from the absorber can be reduced by utilizing a light-pipe geometry. Under concentrations ranging from 150 to 200 suns, it was also shown experimentally that at absorber temperatures less than 500 degrees F the measured instantaneous absorber efficiency exceeded 95%. In those tests the light-pipe was cylindrical. The experimental study is being continued with emphasis on operation at the absorber. In addition, solar intensity mapping using GaAlAs solar cells will be conducted at the outlet of the light pipe. At least three different light-pipe geometries will be studied: cylindrical, triangular and square. At this time the 6 ft concentrator reflector used with the absorber is made from thin film plastic to minimize costs. A paraboloid shape is achieved by maintaining approximately 0.5 psi differential pressure across the film. This novel approach to a high quality reflector has required evaluating different film materials, film seam integrity and rim-film attachment techniques.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

4.0036, INVESTIGATION OF EFFECTS OF MICROWAVES ON GROWTH OF ASPERGILLUS FLAVUS ON CORN

M. Albano, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Natural Sciences, *Princess Anne, Maryland* 21853 (NSG 6033)

The theory and practice of microwave heating are not new, but their use as control measures for insect infestation and in sterilization are recent and spreading widely. This study is to investigate the effect of microwaves on the growth of Aspergillus flavus on corn in storage. Preliminary studies have shown that drying corn by microwaves does not adversely affect the nutritional value of corn. Seed germination does not seem to be adversely affected either.

Corn samples both freshly harvested and dried were exposed to different doses of microwaves. Microwaves were generated on a commercially available microwave oven. At 420 watts, exposures of 60 & 90 seconds showed inhibitory effect. However, at 180 seconds exposure, no inhibition was observed.

The next phase of the project will investigate the effect of microwaves on aflatoxin, produced by A. flavus. It has been shown that irradiation with gamma rays destroys A. flavus spores but was ineffective in altering the aflatoxin B-1 in regard to chromatographic behavior, chemical structure or toxicity. Should microwaves prove to be effective in altering aflatoxin, it could very well be an important point to consider in the possible use of microwaves for drying corn.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

4.0037, TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS FOR NEAR REAL-TIME IMAGE PROCESSING

W.E. Alexander, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 5406)

The two-dimensional recursive digital filter is particularly suited to image processing applications or other bivariate data processing when there is a premium placed upon computer memory requirements and time for processing. Therefore, it has definite advantages over the Fast Fourier Transform (FFT) algorithm for many image processing applications. This project involves synthesis and implementation of two dimensional digital recursive filters for subjective image processing applications. Emphasis is placed upon finding algorithms that offer advantages for near real-time image processing applications.

Currently algorithms are being developed for the University's DEC10 computer for actual image processing. Image display will be with the Department of Electrical Engineering's HP1000 computer system and Grinnell GMR-27 display system. Additional memory is expected to be added to the HP1000 computer system in the near future. After this is accomplished, the algorithms will be moved over to the HP1000 computer system.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

4.0038, PATTERNS OF RESIDUAL STRESSES WITHIN COMPLEX WELDED STEEL STRUCTURES

B.M. Botros, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1516)

This study analyzes the effect of vibration on the patterns of residual stresses generated by welding steel structures. The major objective is to develop some general procedure to relax harmful internal stresses due to welding. A36 steel bars of varying sections were used to build box shapes, two for each design.

In the first phase, thin layers were removed off the metallic surfaces with nitric acid and the residual strains were measured using electric strain gauges. Theoretical formulas and suitable computer programs were developed and applied to reveal the patterns of stress distribution. High tensile stresses of about 25,000 psi were found at the weld, dropping sharply through 4 to 5 inch from the weld zone.

In the second phase of the study each second box was hammered, a spectrum received through an accelerometer and recorded off the screen of an oscilloscope. An effective vibration frequency was chosen through computer modeling, not to exceed 100 cps and the frame was vibrated for approximately 15 minutes. A complete stress analysis followed and the results generally showed that vibration was effective on the embedded stresses. The high tensile stresses at the weld disappeared and a general pattern of low stresses was revealed.

Fatigue testing and other complex welded shapes are still under investigation.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0039, DESIGN AND TESTING OF SMALL COMPOSITE SPECIMENS

A.V. Sharma, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1631)

The effect of low velocity projectile impact on the strength carrying ability of aerospace components fabricated with fiber composites is one of the important factors to be considered in the design. Experimental studies conducted by numerous investigators in this area reveal that the composites exhibit strength degradation when subjected to the low velocity projectile impact. Further, the cost of fabricating the specimens in the experimental studies appears to be high.

OBJECTIVE: In order to reduce the cost of specimens in the experimental studies, it is desirable to find a correlation of properties obtained through the testing of large and small specimens.

APPROACH: Develop different support fixtures to test small laminates in the compression mode subjected to the projectile impact. The buckling strains and strengths at failure would be compared with those obtained from testing larger specimens.

CURRENT PLANS/PROGRESS: The first phase of the experimental program is underway leading to the fabrication of several different support fixtures to stabilize the compression-loaded laminates.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0040, MATERIAL GROWTH AND CHARACTERIZATION OF III-V COMPOUNDS FOR SOLID STATE DEVICES

E.K. Stefanakos, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NSG 1390)

Due to excellent performance of optical fibers in the wavelength range 1.0-1.3 microns, there is real interest to develop new alloy systems and a heterojunction technology for emission in this range. Also, recent theoretical studies carried out on ternary and quaternary III-V compounds to determine candidate materials for MOSFET, TED and IMPATT devices suggest that the quaternary compound InGaAsP can have better high frequency performance than GaAs.

The research will concentrate on the growth and characterization of the quaternary compound InxGa1-xAsyP1-y (0.73 less than or equal to x less than or equal to 0.85, 0.35 less than or equal to y less than 0.6) grown by liquid phase epitaxy on InP substrates. The material characterization studies will include: surface morphology and layer uniformity; resistivity and Hall measurements; capacitance-voltage impurity profiling, photoluminescence and carrier velocity-electric field measurements. The quality of the III-V quaternary epi-layers will be investigated by processing and testing Schottky barrier field effect transistor (FET) structures.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

4.0041, INERTIAL REFERENCE TECHNOLOGY RESEARCH EXPERIMENTS

R.B. Jenkins, University of Southern Colorado, School of Applied Science & Engineering Technology, Dept. of Electronics Engineering Technology, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NSG 2048)

RESEARCH OBJECTIVE: The primary objective of the research effort is to continue research in inertial sensor fault detection and identification technology in order to provide a sound basis for further integrated navigation and flight control system decision making. This goal is accomplished through research and evaluation of systems having the potential for reliable inertial sensor redundancy management.

RESEARCH APPROACH: Inertial sensing redundancy management algorithms using an orthoskew sensor configuration are being developed and evaluated. The algorithm which has the greatest potential in terms of cost, reliability and performance criteria will be flight tested as well.

Three different levels of experimentation are used: computer simulation, laboratory simulation with ring laser gyro sensors, and flight tests in a VTOL environment. Computer simulation involves algorithm development on a large scale computer using the most applicable high-level language. Laboratory simulation experiments are performed on the three best candidate algorithms. These algorithms, using ring laser gyro sensors are then operated in a VTOL environment to determine their reaction to vibration, temperature change, humidity, power source transients, etc.

The redundancy management concept has been extended to include multiple computer fault tolerance. 'Purging' logic is being developed to enable detection and isolation of a faulted computer. Microprocessors are used as the basis for the candidate multiple computer configurations.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

4.0042, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN OF MAXIMUM LIFT AIRFOILS FOR TRANSONIC MANEUVERABILITY

M. James, Dynamics Technology Inc., *3838 Carson St., Torrance, California* 90503 (DN975465; N00014-79-C-0458)

Increased transonic maneuverability is being imposed on Navy combat aircraft because of mission and survivability requirements. Great progress has been made in recent years in the computational design of efficient transonic cruise aircraft, both military and civilian. The capability is now emerging to design for transonic maneuverability with similar success. However, the criteria and limits which must be specified for transonic maneuvering designs are complex and not well defined. It is the objective of this research to investigate the design of optimum transonic maneuvering airfoils and to establish design limits and criteria to be used in this design process.

An inverse computational design procedure for transonic airfoils will be used to establish optimum maneuvering airfoil designs for which the maneuver parameter MDD2CL is maximized. Criteria for establishing permissible shock srength, shock location, pressure distribution, flow separation limits, etc., will be developed for the design process. Geometry criteria to confine the designs to practical shapes which can be achieved from the basic airfoils through variable geometry and/or variable camber concepts will be established.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4.0043, SUPERSONIC FLOW ABOUT YAWED BODIES

J.L. Steger, Flow Simulations Inc., *735 Alice Ave., Mountain View, California* 94041 (DN975536; N00014-79-C-0544)

The development and the utilization of accurate methods to compute the flow fields about bodies at high angles of attack and high speeds is essential for the aerodynamic design and optimization of aircraft and missiles. In the proposed investigation, the laminar flow over a yawed body will be studied within the framework of the Navier-Stokes equations (or a suitable accurate approximation to them). Particular attention will be devoted to the formation of vortices on the leeward side of the body, the formation of cross-flow imbedded shocks, and the strong viscous-inviscid interactions between the boundary layer and external flows.

The approach will be to use both the parabolized Navier-Stokes equations and the more accurate unsteady thin-layer Navier-Stokes equations. The parabolized Navier-Stokes equations will be used to explore the overall flow field in order to establish the particular regions which must be studied in greater detail. The more detailed study will use the parabolized Navier-Stokes equations in a carefully clustered grid. The more accurate unsteady thin layer Navier-Stokes equations will be used to monitor and to supplant the parabolized results when necessary.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

4.0044, RESEARCH IN HIGH-ENERGY PLASMAS

A.J. Lichtenberg, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering & Computer Science, *Berkeley, California* 94720 (ENG78-26372)

This research program involves the theoretical and experimental study of plasma creation, containment, and heating in magnetic mirror plasma device configurations. The research covers the following topics: A. Theoretical and experimental studies relating to adiabatic invariance and its breakdown, with applications to plasma trapping and containment. B. Theoretical and experimental study of axial feedback stabilization of flute modes in a low temperature, multiple mirror plasma. C. Study of cold plasma stabilization of hot-electron plasmas.

This is a continuation of research previously supported under NSF grant ENG-7809424.

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Engineering

4.0045, RESEARCH ON HETEROGENEOUS TURBULENT FLOWS

P.A. Libby, University of California, San Diego Campus, Graduate School, Dept. of Applied Mechanics & Engineering Science, *P.O. Box 109, La Jolla, California* 92037 (DN975362; N00014-79-C-0355)

The objective of this study is to develop a better understanding of variable density effects on turbulence and mixing in non-reactive flows, and the interaction of those effects with chemistry in reactive flows. This information is needed both for improved prediction of the complex mixing and combustion processes within the combustors of aircraft turbojet engines, and to provide a basis for advanced combustor design. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

A mixing region will be formed by injecting a two-dimensional helium jet, which maybe heated, into a moving airstream. Hot wire anemometry and thermometry will be combined with statistical techniques to study the mixing process. The present jet generator will be modified to obtain improved two-dimensional results close to the point of injection. Further measurements will be made both in this region and downstream under the influence of a streamwise pressure gradient. A coordinated theoretical study of turbulent reacting flows with pre-mixed reactants will be carried out utilizing an improved representation of the turbulent transport. Emphasis will be on the interaction between the turbulent fluctuations and the reactive heat release, with specific application to oblique flames and the effects of acceleration on turbulent flames.

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Naval Research

4.0046, RESEARCH ON WALL TURBULENCE 13681-E

R.F. Blackwelder, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0E9203; DAAG29 76 G0297)

To experimentally explore the unsteady eddies that occur naturally in turbulent shear flows. Relevance - new turbulence models are needed for prediction methodology in missile aerodynamics, rotorcraft aerodynamics and interior and exterior ballistics.

Special techniques will be developed to cope with the random phase which occurs whenever detecting and sampling occur at different spatial locations. The relationships between turbulent bursts and the outer flow field will be examined and the downstream evolution of the bursting phenomena will be investigated utilizing these specialized techniques.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4.0047, MEASUREMENT OF INTERACTION OF MILLIMETER WAVES WITH WATER VAPOR ON EARTH-SPACE PATHS 15957-GS

D.C. Hogg, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., *Boulder, Colorado* 80302 (DA0G9129)

To develop a method for remotely sensing atmospheric water vapor through better understanding of the absorption properties of water vapor at millimeter wavelengths. Relevance - the research has relevance to remote sensing of atmospheric water vapor, satellite-communication signal attenuation, and radiometric approach to the Army millimeter wave program.

Absorption by water vapor will be measured using a radiometric system consisting of channels at 20.6 gHz and 31.6 gHz. Simultaneous humidity measurements will be taken by radiosonde, and absorption calculated from the water vapor profiles observed. The data will be analyzed to establish extrapolation to near millimeter wavelengths and to determine the temperature dependence of the absorption.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

4.0048, WAVEGUIDE COUPLERS

W.K. Burns, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980231)

To assist in the development of improved techniques for coupling laser sources to waveguides and to characterize light propagation into these guides. Techniques will be investigated to improve coupling of diode lasers into waveguides. Butt coupling techniques will be studied initially with later studies to include an assessment of the viability of grating couplers. The propagation characteristics of the coupled light will also be investigated with emphasis on scattered light reduction.

Experimental and analytical studies will address problems associated with coupling diode lasers to waveguides. Output beam patterns will be measured for both waveguides and lasers and coupling efficiencies will be maximized by tailoring these profiles. Coupling via waveguide gratings will be investigated analytically to define problem areas and to project coupling efficiencies. The characteristics of light propagating in the waveguides will be determined and techniques to suppress scattered light will be developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0049, MOTION SYSTEM TESTING

W.T. Harris, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Advanced Simulations Concepts Lab., *Orlando, Florida* 32813 (DN994014)

Develop the necessary materials and program to provide the ability to perform (a) acceptance testing, (b) quality assurance and revalidation testing, (c) daily readiness testing and (d) diagnostic testing of synergistic cockpit motion hardware.

Develop the testing plan, award contract for software services, test software and hardware developed, field test the testing program and apparatus.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Advanced Simulations Concepts Lab.

4.0050, A GENERALIZED WAKE-INTEGRAL APPROACH FOR DRAG DETERMINATION IN THREE-DIMENSIONAL FLOWS

J.C. Wu, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (ENG79-00891)

This is joint project between Georgia Institute of Technology and Lockheed-Georgia Company on determination of drag, its nature and its distribution from measurements made in the wakes of finite bodies, including lifting cases.

The theoretical portion will be carried out at Georgia Tech while the wind tunnel experiments will be carried out at Lockheed-Georgia. The primary objective will be to develop a generalized wake-integral approach for drag determination in three-dimensional flows.

Emphasis on energy conservation has sharpened the need to understand the drag producing mechanisms. This project could well lead to new ideas concerning low drag or energy efficient configurations for both future aircraft as well as land based vehicles.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0051, INTERACTION OF VARIOUS MATERIALS WITH HIGH-TEMPERATURE, HIGH DENSITY PLASMAS

K. Kim, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

A hypocycloidal-pinch plasma device has been constructed to investigate the interaction of high temperature (approximately 1KeV), high-density (approximately 10 to the 18th power cc) plasmas with various materials. Subjects of particular interest are: Study of particle-plasma interaction for different probe particles, investigation of soft X-ray emission characteristics from various filling gases, development of a high-power UV source, and study of laser-plasma interaction, which includes plasma heating.

SUPPORTED BY University of Illinois

4.0052, MINIMUM-FUEL ORBIT TRANSFER IN SIMPLE GRAVITATIONAL FIELDS

J.E. Prussing, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Aeronautical & Astronautical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801

The subject of minimum-fuel impulsive orbit transfer has received a great amount of attention over the past fifteen years. The problem is quite complex and a complete solution for an inverse-square gravitational field is not known. The purpose of the current investigation is to apply primer vector theory to the simplified cases of uniform and field-free cases, describe all the types of minimum field transfers, and gain insights which may lead to new solutions for more complex fields.

SUPPORTED BY University of Illinois

4.0053, STOCHASTIC LANGUAGES AND THEIR APPLICATIONS TO SIGNAL AND IMAGE PROCESSING

K.S. Fu, Purdue University, School of Electrical Engineering, Dept. of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DN975495; N00014-79-C-0574)

To improve the Navy's surveillance capabilities by developing improved stochastic languages and associated statistical methods for applications to signal and image processing.

Statistical and probabilistic research will be performed to develop improved methods for target identification and texture discrimination of satellite images. In particular research work will include (1) the investigation of stochastic graphs and stochastic graph grammars for pattern description, (2) the extension of certain inference algorithms to tree grammars and (3) investigation of stochastic error correcting syntax analysis for tree languages.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0054, NUMERICAL STUDIES OF UNSTEADY SUPERSONIC MIXING FLOWS

J.D. Anderson, University of Maryland, College Park Campus, School of Engineering, Dept. of Aerospace Engineering, *College Park, Maryland* 20742 (DN775431; N00014-77-C-0257)

Mixing phenomena play a central role in many fluid dynamic applications ranging from the flow at the trailing edge of a wing to the flow in a chemical laser. The proposed research will examine, numerically, the mixing between two co-flowing jets in which oscillations, representative of controlled input disturbances, will be introduced.

In recent years significant progress has been made in the interpretation of the nature of the mixing of two, steady, planar, co-flowing jets. The planned numerical work will examine the influence of controlled time-dependent disturbances on the diffusion between the two jets. The calculations will use the time-dependent Navier-Stokes equations. Jets of the same composition as well as dissimilar jets will be studied. For turbulent flows, a kinetic energy model will be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0055, THERMAL STABILITY OF POWER TRANSISTORS

D.H. Navon, University of Massachusetts, Amherst Campus, School of Engineering, Dept. of Electrical Engineering, *Amherst, Massachusetts* 01002 (ENG79-01819)

Characteristics of semiconductor power switching devices are being investigated with the aid of numerical models. Specific problems being considered include: 1. The operation of V-groove MOSFET (metal-oxide-semiconductor field-effect-transistor) structures under high current and high voltage conditions, taking temperature into account. 2. The operation of the V-MOSFET as a high current, high speed switch. 3. The limitations on power handling capability of V-MOSFET and V-groove junction FETs. 4. The power limitations of V-FETs in an inductive circuit environment. 5. Design criteria for optimum performance of the V-FET as a high frenquency device.

This is a continuation of research previously supported under NSF grant ENG-7509334 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0056, DROPLET MOTION INDUCED BY WEAK SHOCK WAVES

S. Temkin, Rutgers the State University of New Jersey, New Brunswick Campus, School of Engineering, Dept. of Mechanical Aerospace & Industrial Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (ENG76-105045 A02)

This action provides renewal support for NSF Grant ENG 76-15045. Two year experimental study of the unsteady motion of small liquid droplets responding to the passage of weak compressive wave pulse will be carried out in a shock-tube facility completed under the previous grant. Water droplets with diameters in the range of 50-500 microns will be exposed to the wave with the resulting Reynolds number in the range of 10-100.

The main objective of this investigation is to measure the response of small water droplets to 'N-Waves.' These have both negative and positive fluid velocity regions, so that they may be used to study, under controlled conditions, the effects of acceleration and deceleration on the drag. The information obtained in this investigation is of importance in many situations of practical interest. In particular, it is needed in studies of droplet coalescence in thunderclouds, and in the study of techniques used to coagulate industrial aerosols as a means of reducing particulate air pollution.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0057, TRANSONIC TURBOMACHINERY INLET CONDITIONS

W.J. Rae, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DN890139; N000019-78-C-0603)

To develop methods for treating inlet conditions in transonic turbomachinery flow field calculations.

Theoretical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0058, CARS INVESTIGATIONS IN TURBULENT, SOOTING FLAMES

M. Lapp, General Electric Co., Research & Development Center, *1 River Rd., Schenectady, New York* 12305 (DN975437; N00014-79-C-0381)

The objective of this research effort is to provide a scientific basis for a non-perturbing, space and time resolved optical probe of gas temperature and constituency in combustion systems, based upon laser Raman scattering. Such optical sensors will be useful initially for providing detailed access to temperature and species concentrations in combustor flows as well as to possibly providing signals for control purposes - all necessary for improved propulsion systems for naval aircraft and missile applications.

Techniques developed during the past several contract years will be utilized to measure flame product gas density from vibrational Raman scattering stokes q-branch signals, and temperature from the corresponding Stokes/anti-Stokes ratio of the nitrogen. Axial velocities will be measured by use of laser velocimetry apparatus. A pulsed dye laser source operating in the mid-visible will be used for the Raman effort, in conjunction with spectrometer/photomultiplier or other advanced forms of detection.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0059, QUASI-OPTIC STUDY OF DIELECTRIC RADOMES AND LENSES 15369-EL

L.B. Felsen, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Aerospace Engineering & Applied Mechanics, *333 Jay St., Brooklyn, New York* 11201 (DA0F9276; DAAG29-78-G-0168)

To provide improved methods for calculating the effects of radomes on missile and aircraft antennas and to determine the limits over which classical geometric optics may be applied to determine radome effects. Relevance - results of this research are directly relevant to Army systems requiring high performance antenna-radome combinations, e.g., missile radomes, and low-sidelobe, high precision radar radomes.

A rigorous solution for the radome will be formulated and evaluated via asymptotic methods. The analysis will contain contributions of leaky modes, whispering gallery modes and surface waves as well as the usual ray optical contributions. The relative importance of each of these terms will be assessed.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0060, RADAR BEACON DATA LINK

J. Monson, Syracuse Research Corp., *Merrill Ln., Univ. Heights, Syracuse, New York* 13210 (DN890169)

Establish radar beacon data link capability for Marine Corps forward air controllers (FACS).

Modify PPN-18 FAC radar beacon to allow for manual insertion of range/bearing to target and altitude difference between target and FAC, and to provide automatic encoding of beacon replies to strike aircraft radar interrogations, design decoder/display for A-6E cockpit.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0061, AVIONICS RELIABILITY ASSESSMENT

T. James, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF099740)

Establish a recurrent identification of reliability/maintainability problems by work unit code and/or NSN's of avionics equipment for all systems. Identification should delineate where reliability growth can be effectd by action from the AFAL technical divisions. The reliability parameters of the problem equipment should be evaluated and compared to equipment change effected by the technical divisions.

The equipment with problems identified on the data product (1) are to be evaluated for existing reliability parameters (MTBF, shape, scale of the failure distribution) and statistical tests of reliability improvement in the parameters values conducted on data supplied from AFAL technical division action. To do statistical analysis of the results obtained under the combined environmental reliability test (CERT) to influence reliability testing in the future, evaluation of the total CERT concept as a reliability test program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0062, NON-SATELLITE COMMUNICATIONS RELAY

R. Enderson, Raven Industries Inc., Electronic Systems Division, *205 E. 6th St., Sioux Falls, South Dakota* 57101 (DN981054; N62269-78-C-0452)

The technical objective of this task is to provide sufficient test data and analysis to demonstrate the feasibility of a ballonborne expendable relay for communications purposes. This work supports work unit ZE103, Agency Accession DN 681003.

The approach is to purchase balloon systems previously developed to provide platforms for test purposes.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

4.0063, CLASSIFICATIONS OF SOLUTIONS OF THE THREE-BODY PROBLEM

R.A. Broucke, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

A classification of periodic orbits in the planar general three-body problem is being made. Approximately twenty new families have been obtained by varying the masses or another parameter such as the rotation angle. A systematic study has been made on the types of solutions of two particular cases of the general problem; the non-rotating rectilinear problem and the planar isosceles triangle problem. Several new forms of equations of motion have been discovered for the three-body problem.

SUPPORTED BY University of Texas

4.0064, NOISE GENERATION IN MECHANICAL SYSTEMS - IMPACT NOISE

N.D. Perreira, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: An analytical and experimental investigation of the acoustic noise produced during and after impacts of mechanical system elements is being examined. The noise sources being examined include the aeroacoustic noise generated by the air ejection from the impact site and the noise due to the system surface motions. These motions are comprised of the gross accelerations of the impacting bodies, local deformation near the impact site, surface and other traveling waves generated at the impact site, and standing waves or vibrations of the two impacted bodies.

We are presently attempting to identify the element and impact characteristics that determine the dominate noise source or sources. Analytical modeling and experimental verification of these models will follow.

SUPPORTED BY University of Texas

4.0065, PROPERTIES OF MERCURY-CADMIUM-TELLURIUM SOLID SOLUTIONS

R.F. Brebrick, Marquette University, School of Engineering, Dept. of Mechanical Engineering, *1515 W. Wisconsin Ave., Milwaukee, Wisconsin* 53233 (DF052440; AFOSR-78-3611)

AF function - secure space communications and covert optical electronics require devices which exploit properties and interactions of materials with far infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective -this research seeks a reliable interpolation scheme to characterize the pseudobinary solid solution series of mercury, cadmium and tellurium for the growth of mercury-cadmium telluride materials of potential use in infrared detectors and sources. Based on measurements of the partial pressures of both mercury, cadmium-saturated and tellurium-saturated solid solutions, the Gibbs free energy, enthalpy and entropy of formation will be calculated. In addition, the chemical potentials of the solid solution components, HgTe and CdTe will be calculated in a thermodynamically self-consistent fashion. How work contributes-the proposed measurements and calculations will furnish basic phase diagram and thermodynamic information for better defining the conditions for growing (Hg,Cd)Te crystals with controlled optical properties. The key problem is the growth of large, stoichiometric crystals of uniform composition is the partial pressure and the solidus temperature of mercury.

Partial pressures will be determined by measuring the optical density (and transmission in the case of Cd) between 220 and 500 nm of the vapor in equilibrium with the solid solutions. Samples that are metal-saturated at some temperature above 300 degrees c will be prepared by adding a known excess of Hg (the predominant vapor species) to known weights of the solid solution. Because of the high Hg pressures anticipated and the limited size of the sample (1/2 to 5 gm), it will be necessary to establish the temperature-volume profile in the fused silica optical cells so that changes in the composition of the solid solution can be followed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, DEVELOPMENT OF CAPABILITIES FOR COMPUTER PROCESSING OF REMOTELY SENSED DATA AT A MINORITY INSTITUTION

O.L. Montgomery, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resources & Environmental Studies, *Normal, Alabama* 35762 (NSG 8066)

This initial three-year project provides for the development of a computer processing capability in the analysis of remotely sensed data. The 'Remote Sensing Program' at Alabama A&M University, will make the transition from a 'project' to a 'program' oriented remote sensing center.

The objectives are four fold in nature: (1) to further establish and strengthen research efforts currenly underway at Alabama A&M University, (2) to develop and test new and improved methods of analyzing and extracting information from remotely sensed data in a cost-effective manner, (3) to identify and cooperate with potential users of remotely sensed data, (4) to provide for the orderly and efficient transfer of the technological advancements of the sciences.

Program areas have been developed as a means of fulfilling the objectives. The program areas are as follows: (1) research and development, (2) application testing and technology. Through these program areas, the center hopes to develop, test, and transfer the science of remote sensing and its applications to the solution of agricultural, natural resource and land use inventorying, monitoring and assessment problems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0002, THE MOTION OF PARTICLES IN INTERSTELLAR SPACE RELEASED FROM A NUCLEAR WASTE PAYLOAD CONTAINER

A.C. Williams, Alabama Agricultural & Mechanical University, Graduate School, *Normal, Alabama* 35762 (NSG 8068)

This project is a theoretical investigation into one aspect of a feasibility study related to the disposing of nuclear waste in space. The effect of the nuclear waste payload disintegrating into small particles and the resulting long-term earth reentry risk of the particles is looked at. Work in progress has indicated that for certain size particles, significant electric charges can accumulate which gives rise to a resultant electromagnetic interaction with the interplanetary magnetic field. Further work will be done in parameterizing the various interactions of the particles with the interplanetary environment.

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0003, MEASUREMENT OF TOTAL ELECTRON CONTENT AND IONOSPHERIC ELECTRON CONTENT VIA FARADAY ROTATION AND GROUP DELAY TECHNIQUES

M.P. Paul, Alcorn State University, Graduate School, Dept. of Industrial Education & Technology, *Lorman, Mississippi* 39096 (NGR 25-012-001)

Total electron content has proved to be a very useful ionospheric parameter. The measurement of this parameter has been greatly simplified by the proliferation in the number of presently orbiting geostationary satellites. A field station was set up on this university campus for the routine measurement of this parameter via Faraday rotation of 173.35 MHz transmissions of ATS-1 and ATS-3. Data obtained so far since July, 1974 have been analyzed to study their temporal variation and are found to be consistent with the data obtained at other midlatitude stations.

Recently this facility has been used for the experimental investigation of horizontal temporal evolution of ionospheric modification created by rocket exhausts via spaced-receiver technique. Data obtained show excellent promise.

Our plans for the simultaneous measurements of ionospheric, total and plasmaspheric electron content during the third phase of ATS-6 via Faraday rotation and group delay techniques were a great success. Our receiving system was on air in December, 1976 and data collection was continued up to shortly before the transmission schedule was permanently terminated. Results obtained are found to be consistent with those obtained by other midlatitude experimenters and reveal a wealth of information on the diurnal variation of ionospheric and plasmaspheric contents, especially during the periods of geomagnetic disturbances.

Our future plans are to continue this type of routine measurement and thereby establish the trend of long-term variation of the parameters.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0004, IONOSPHERIC, TOTAL AND PROTONOSPHERIC ELECTRON CONTENT MEASUREMENTS AT A MIDLATITUDE STATION

M.P. Paul, Alcorn State University, Graduate School, Dept. of Industrial Education & Technology, *Lorman, Mississippi* 39096 (NGR 25-012-001)

Total electron content has proved to be a very useful ionospheric parameter. The measurement of this parameter has been greatly simplified by the proliferation in the number of presently orbiting geostationary satellites. A field station was set up on the Alcorn State University campus (31.5 degrees North latitude, 91.06 degrees West longitude) for the routine measurement of this parameter via Faraday rotation of 137.35 MHz transmission of ATS-1 and ATS-3. Data obtained so far since July, 1974 have been analyzed to study the temporal variation of this parameter and are found to be consistent with the data obtained at other midlatitude stations.

These equipments have also been used recently at different temporary field stations on the east coast of Florida for studying the ionospheric hole, its creation by rocket exhaust and its horizontal and vertical temporal evolution during the rocket launching on September 19, 1979 and measuring the Faraday rotation of satellite SIRIO signal. The data, which seem to be very promising and presently under analysis, will be reported elsewhere.

Our plans for the simultaneous measurements of ionospheric, total electron and plasmaspheric contents during the third phase of radio beacon experiment of ATS-6 via Faraday rotation and group delay techniques were a great success. Our receiving system was on air in the middle of December, 1976 when the satellite was maneuvered to its final longitude location and continued data collection until the conclusion of this transmission program. Results obtained from partial analysis of data are consistent with the results obtained by other select groups of experimenters around the world and reveal a wealth of information on the diurnal variation of ionospheric and plasmaspheric contents, especially during the periods of geomagnetic disturbances.

Our future plans are to continue this type of routine measurement.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0005, PIONEER VENUS PROBE ANOMALIES IN LOWER VENUS ATMOSPHERE

J.K. Goodman, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-675908)

ABSTRACT. Four Pioneer Venus Probe spacecrafts entered the Venusian atmosphere on December 9, 1978, and descended to the surface while making in situ measurements of chemical composition, structure and radiative balance. In the lower Venusian atmosphere, a number of anomalous events were noted in some of the scientific instruments and probe engineering data at approximately the same altitude. The objectives of this study are to 1) formulate the range of atmospheric states and conditions at the anomaly levels that are consistent with the overall planetary circulation models and U.S./Soviet probe measurements, 2) extrapolate the mesoscale and microphysical conditions at these levels that are capable of generating and maintaining electromagnetic fields of the order necessary to cause the anomalous reading and 3) examine the potential spacecraft induced atmospheric interactions that could generate and/or enhance these conditions.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0006, STUDY OF PLANETARY METEOROLOGY

C.A. Riegel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-2)

An investigation into the response of the Martian atmosphere to the growth and decay of the polar caps is proposed through the use of a zonally averaged numerical model based on the complete set of hydrodynamic equations. The efficacy of the model is its ability to isolate the baroclinic and mass exchange processes that characterize the polar regions. The results will be used to assess the dust-raising capability of the polar cap winds and to enhance our understanding of general atmospheric processes. A method for improving the estimates of threshold wind speeds is also proposed.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0007, FURTHER DEVELOPMENT OF THE AMES TWO-DIMENSIONAL MODEL

C.A. Riegel, California State University & Colleges, San Jose State University, Graduate School, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NSG 2130)

The two-dimensional stratospheric model developed by scientists at the NASA-Ames Research Center, in collaboration with Dr. C. A. Riegel of SJSU, has been applied to studies of perturbations of the terrestrial ozone layer (e.g. see Borucki et al., 1976). Since February, 1976, research supported by NASA Grant NSG 2130 has resulted in substantial speed-up of the model with regard to computer time requirements. This speed-up has reduced the costs of running the model by 40% without severely affecting the accuracy of the solution. Additional reductions are anticipated by the contract expiration date of March 31, 1978. Thus it should now be possible to expand the model to enable the study of additional problems. To this end, it is proposed that the model include the following: a) diurnal averaging of aeronomic rate coefficients, b) inclusion of sulfur compound chemistry and aerosol model, and c) a study of the effects of carbon compounds in the stratosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0008, STRATOSPHERIC-MESOSPHERIC DYNAMICS

C.A. Riegel, California State University & Colleges, San Jose State University, School of Science, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCA 2-0R675-809)

Ames and San Jose State University scientists have developed a two-dimensional model that treats the chemistry of minor constituents in the stratosphere and mesosphere and includes bulk flow and eddy transport. This model includes reactions involving nitrogen, hydrogen and chlorine oxides, and is being used to assess the environmental effects of aerospace vehicle operations and of releases of chlorofluoromethanes. Results of the model calculations are in reasonable agreement with observations; but further refinements are desirable.

In addition, Ames scientists have continued work on a submodel of stratospheric-mesospheric dynamics. Professor Riegel of San Jose State University is assisting in the development of this model by advising on necessary meteorological approximations and in comparing model performance with observed atmospheric structure.

Furthermore, Ames scientists conducted an extensive observational program in Panama during July 1977. Large amounts of meteorological data were collected and are being processed. These data must be interpreted and correlated with air samples taken by aircraft observations for studies of tropospheric-stratospheric exchange in the tropics.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0009, STRATOSPHERIC POLLUTANT TRANSPORTS BY PLANETARY WAVES AND TROPICAL CIRCULATIONS

C.A. Reigel, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Meteorology, *Washington Sq., San Jose, California* 95192 (NCC 2-17)

In the past decade there has been increasing concern about the impact of pollutants on stratospheric ozone, and the resulting effects on the biosphere in the event of significant ozone reductions. Possible pollutants include NOx emissions from high-flying SST's and heavy lift launch vehicles (McConnell and McElroy, 1974), fluorocarbons from aerosol sprays and refrigerants (Turco and Whitten, 1979), and N2O gas from the increased use of fertilizers in agriculture (Crutzen, 1972). The photochemistry of the species is complex; moreover, since they interact strongly with atmospheric motions, a proper assessment of stratospheric pollution requires a three-dimensional dynamical model. The development of such a model entails numerous difficulties, in particular the impossibility of simulating every dynamical phenomenon of the atmosphere. To some extent, then, one must know beforehand what the most important mechanisms for pollutant transport are so the model can be designed to simulate or parametrize them properly. This requires a theoretical understanding of observed atmospheric phenomena, and an ability to understand their implications for pollutant transport.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0010, VERIFICATION OF SEASAT WIND SPEED AND DIRECTION - GLOBAL CAPABILITY FOR EXTRA TROPICAL CYCLONES (ABBREV)

W.J. Pierson, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Oceanography, *Convent Ave. & 138th St., New York, New York* 10031 (NAS 1-15669)

The purpose of this program is to improve upon the results obtained in 1978-79 based on a re-calibration of the sigma nauget measurements made by the SeaSat scatterometer. Improved wind vector algorithms will be computed so as to determine the accuracy with which the SASS has measured the winds over the ocean. Mesoscale turbulence features will be studied in terms of frequency spectra for frequencies corresponding to periods from two minutes to three hours so as to balance the 'error' budget in comparison of conventional measurements with the spacecraft data. Finally, these new results will be used to study selected extra tropical cyclones and tropical cyclones in which high winds and large wind gradients occurred.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0011, ATMOSPHERIC KINETIC INVESTIGATION

J.B. Halpern, Howard University, Graduate School, *2400 6th St. N.W., Washington, District of Columbia* 20001

Based on previous work of the principal investigator, several special cases have been identified in which two photon excitation should be especially strong. In particular it is proposed to detect CO using the TPE of the Hopfield-Birge systems, and to measure the excitation by monitoring the cross-fluorescent decay to the A state. In OH, close accidental coincidences with the strong (5,0) ground state vibrational transition, one of the Meinel bands, should greatly enhance the TPE of the A state, whose fluorescent decay would be a measure of the amount of OH present. This method avoids the problem of OH radical generation from two photon dissociation of water vapor which limits current laser induced fluorescence measurements. Especially for CO and other diatomic molecules, whose first allowed absorption is in the VUV TPE may be a superior method for remote ambient detection.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

5.0012, LANDSAT STUDY RELATING SOIL ZINC CONTENT TO INCIDENCE OF DIABETES

I.G. Molnar, Lincoln University, School of Agriculture, Dept. of Agricultural & Natural Resources, *Jefferson City, Missouri* 65101 (NSG 13-1)

There is a considerable body of research which suggests a relationship exists between diabetes and zinc deficiencies within various animals and man. The objective of this research is to combine information obtained from epidemiological studies of the incidence of diabetes with zinc content of soils as indicated by geochemical maps of Missouri. Efforts will be made to expand and refine existing geochemical maps using Landsat data.

PROGRESS/CURRENT PLANS: Contract awarded in December 1979. Initial work currently underway.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
National Space Technology Lab.

5.0013, X-RAY DIFFRACTION STUDIES OF SHOCKED LUNAR ANALOGS

R.E. Hanss, St. Marys University, School of Arts & Sciences, Dept. of Geology, *2700 Cincinnati, San Antonio, Texas* 78228 (NSG 9039)

This project aims -methods for determining the shock pressures experienced by terrestrial lunar analogs involved in cratering processes, and (2) to determine by X-ray diffraction methods the distribution of shock pressures experienced by mineral grains in naturally and artifically shocked samples.

This research utilizes X-ray powder diffractometry (line-broadening studies) and Debye-Scherrer single-grain studies. The samples are lunar analog standards shocked at the Johnson Space Center flat-plate accelerator, nuclear-shocked granodiorite from the Piledriver test in Nevada, and naturally shocked suevite from the Ries Crater in Germany.

Diffractometer standards have been completed for shocked quartz, orthoclase, oligoclase, enstatite, and olivine. A preliminary article on the technique was published in Advances in X-ray Analysis 20, 337-344 (1977). Debye-Scherrer studies of the nuclear-shocked and accelerator-shocked granodiorite are completed, as are about one-half of the naturally shocked Ries samples. Comparison has been made of all three Debye-Scherrer studies. The distribution of shock pressures around a terrestrial impact crater was measured using the application of methods studied. Research is essentially complete, and final reports are in preparation.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

5.0014, SURFACE DRIFT CURRENTS IN THE OCEAN

J.J. Dudis, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6025)

Surface drift currents in the ocean are composed of two types of flow--the classical Ekman flow where Coriolis and viscous forces are balanced and the Stokes drift resulting from irrotational gravity wave motion. The purpose of this project is to model theoretically this interaction of wind stress, viscosity and the earth's rotation, including recognition of the separate modes of motion and understanding the conditions under which they exist.

Initial effort has been spent in considering the drift current induced by a non-rotating, viscously modified surface gravity wave. Boundary layer calculations have rectified the contradictory results, regarding the magnitude of the surface drift velocity in deep-waves, which were obtained by previous investigators using differing analytic approaches.

Present work concerns resolving the still unrealistic surface currents obtained from this model under certain limiting conditions. In the future, the more complex problem which includes the additional interaction mechanism of the earth's rotation will be considered.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0015, ELECTRON MICROPROBE STUDY OF LUNAR AND PLANETARY ZONED PLAGIOCLASE FELDSPARS

R.K. Smith, University of Southern Colorado, School of Applied Science & Engineering Technology, Dept. of Data Processing, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NSG 9051)

Compositionally zoned plagioclase feldspars, as members of a continuous reaction series, reflect the external temperature-pressure conditions and bulk composition of a crystallizing silicate melt. Though difficult to interpret, plagioclase zoning is a potentially useful tool for understanding lunar and planetary magmatic processes and recognizing sequences of magmatic events. Because the current understanding of plagioclase zoning is stll unsatisfactory, a detailed investigation of naturally grown and synthetic grown zoned plagioclases was begun in Feburary 1977.

The present study has consisted of (1) a detailed petrography of numerous igneous rock thin sections whose plagioclase feldspars contain oscillatory and other types of zoning; and (2) a detailed electron microprobe study of these samples for compositional data. Three zoned plagioclases were selected for analysis by a new technique for collecting and presenting areal electron microprobe data. This new technique utilizes a computerized real-time data collection system that gathers X-ray photon counts from the microprobe spectrometers as the microprobe electron beam scans the specimen surface. After appropriate data processing the computer draws elemental concentration contour maps from two-dimensional data matrices collected for each element.

Comparisons of the above microprobe data with optical determinations have been made on a portion of the samples, and are being completed on the remaining samples. Preliminary results have been presented to the Geological Society of America. A final report is being prepared for publication.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0016, OCCURRENCE AND MINERAL CHEMISTRY OF HIGH PRESSURE PHASES, POTRILLO BASALT, SOUTH CENTRAL NEW MEXICO

J.M. Hoffer, University of Texas, El Paso Campus, School of Science, Dept. of Geological Sciences, *El Paso, Texas* 79902 (NSG 9062)

A study is underway to investigate the occurrence, distribution, mineralogy, and geochemistry of high pressure megacrysts from cones and lavas in the Potrillo Basalt field of south central New Mexico. This investigation will form the basis for evaluation of current experimental studies in crystal growth of megacrysts in the earth's mantle.

Megacrysts of feldspar, pyroxene, amphibole, and xenoliths of olivene-pyroxene-spinel occur abundantly in the volcanic rocks of the Potrillo Basalt; they are found in isolated crystals within volcanic bombs associated with the older cinder and maar volcanoes, or as inclusions in basalt flows. To date only the olivine-pyroxene-spinel modules and selected feldspar megacrysts have been studied. It has been concluded that the feldspar megacrysts were formed under high pressure and came from great depth. However, to date, very little data is available concerning the distribution, variation, and composition of a megacryst suite from a single volcanic area.

Detailed collection of megacrysts in the Potrillo Basalt has been carried out, and sample areas are being mapped to estimate abundance and distribution of the various megacryst types. Petrographic thin sections of megacrysts are being studied to determine texture and mineralogy, and major element determinations are being made by x-ray fluorescence analysis. The results of these studies should provide basic data on the interior of the earth as an example of how one would analyze similar samples should they be returned from other planetary bodies.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0017, MEASUREMENT OF BI-DIRECTIONAL REFLECTED SPECTRA AND CORRELATION TO AGRONOMIC PARAMETERS

R.A. Watlington, University of the District of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NSG 5290)

The research on this project is intended to establish the reliability of bidirectionally scanned reflectance spectra for accessing various agronomic parameters of specified agricultural subjects.

The research involves using two and three band, hand-held radiometers as well as a truck-mounted, 395 band spectroradiometer to scan the specially prepared fields of corn, soybean, and wheat at the Beltsville Agricultural Research Center. These scans will be cross-referenced to the physical characteristics and growth stages of the crops and will be conducted as a function of look angle primarily. Concurrently, the effects of changing sun angles, cloud conditions and atmospheric state will be recorded and considered to minimize inaccuracies in correlating agronomic measurable to look angle (at specific wavelength) - or to wavelength (at specific look angle.)

The expected products of this project are: 1) a model correlating bidirectional radiometric spectral information to specific crop parameters, such as species or growth stage; 2) an analysis of the feasibility of the bidirectional approach (compared to conventional zenith-look approaches) for earth-surface and satellite studies of agronomic subjects; and 3) an algorithm for considering the effects of sun angles and observer look angles upon detected reflected radiance.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0018, APPLICATION OF REMOTE SENSING TECHNOLOGY TO MANAGEMENT OF AGRICULTURAL AND NATURAL RESOURCES OF ALABAMA

O.L. Montgomery, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Natural Resources & Environmental Studies, *Normal, Alabama* 35762 (0077538; ALAX-011-479)

OBJECTIVE: Develop a remote sensing processing capability in Alabama, for rapid inventory, assessment and monitoring of the resources of the state. Determine the feasibility of providing current and accurate soils map from remotely sensed data.

APPROACH: Proposed the acquisition of an intermediate remote sensing terminal which will be connected to the control machine processing center at the Laboratory for Applications of Remote Sensing (LARS), Purdue University via telephone line. Concurrent with the installation of the processing terminal will be the acquisition of remotely sensed data over north Alabama. The computer compatible tapes containing data over the areas of interest will be forwarded to the LARS computer facility where they will be stored in the tape storage area set aside solely for use by persons at this terminal site. The visible and photography, topographic maps and ground observation data will be stored at terminal site.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Alabama

5.0019, VOYAGER MAPPING

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-01973)

In 1978, the design of the cartographic data reduction scheme was completed. This includes geometric transformation and enhancement of images by digital pressing; establishing geodetic control nets using data provided by Mert Davies, Rand Corporation; generation of controlled mosaics; and production of selected shaded relief bases.

Primary goal of the Voyager Mission is to generate topographic and geologic maps of five satellites of Jupiter based on 1500 images that will be acquired by the cameras of Voyagers 1 and 2 during the period of March through May-June 1979. Data reduction efforts will begin in March 1979 and continue to FY 82.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0020, PG-HISTORY OF CHRYSE HYDROGRAPHIC BASIN

H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (9580-02360)

Most geologists agree that the large channels that descend into the Chryse basin from the south and southwest are fluvial in origin. However, only from the recently obtained high resolution stereoscopic Viking photography can we (1) attempt to date the channeling episodes by crater counts, (2) estimate the volume of water that has traversed the channels and (3) estimate the volume of collapsed terrain that may represent melted subsurface ice that provided the water. One of the most interesting problems defined in the investigation of Mars is the possibility that different climatic conditions may have recurred repeatedly in the past. Questions concerning the evolution of the Martian atmosphere, and the posible presence of life in the past are intimately tied to the channel and volcanic history. The Chryse basin may be the best area on the planet to investigate these questions.

Geologic maps of channel areas, source areas, and debouchment areas will be drawn, using newly available Viking mosaics as a base. Topographic (contour) maps will be prepared of selected areas. Profiles will be drawn in additional areas of high interest from stereophotogrammetric and radar data. Crater counts will be made of all channel areas and the surfaces into which channels are cut. The volume of collapsed terrain will be computed from mosaics, topographic maps and profiles. In this way the most quantitative estimates possible will be made for the processes affecting the hydrographic basin. The geologic relations elucidated by mapping and crater counting will lead to the delineation of a geologic history.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0021, SURFICIAL GEOLOGY OF THE EQUATORIAL REGION OF MARS

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The objectives here are: 1. to characterize regional color boundaries and units as they evolve with season on Mars, 2. to establish correlations among terrain morphologies, ages, and colors, 3. using high resolution Viking images to establish the nature of boundaries between and textures within units, 4. to generate maps of the color-terrain-age texture units, and 5. to analyze isolated high resolution color images and important targets, particularly of the Viking landing sites, to establish the regional context of the material units recognized a higher resolution. Based on earlier work from Viking approach color data, it appears that although primary lithologies produced by a variety of processes control regional color, the overriding influence is by eolian transport over timescales from days to perhaps billions of years. Hence, the prime focus in our initial objectives if the apparent eolian units and stratigraphy (Soderblom et al. 1978) that pervades the central and north equatorial region of Mars; hence, this work is clasifed as an eolian project.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0022, OPERATIONAL APPLICATIONS OF SATELLITE SNOW COVER OBSERVATIONS AND DCS OPERATIONS IN THE ARIZONA TEST SITE

H.H. Schumann, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Phoenix, Arizona* (AZ 75-041)

The Landsat, NOAA, and SMS/GOES satellite imagery will be the primary source of obtaining repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of satellite telemetry systems to furnish timely and meaningful hydrologic information for use by water management.

1. To evaluate repetitive satellite imagery together with aerial surveys in an attempt to develop an operational capability in Arizona for using satellite imagery for mapping the distribution of snowcover on the Salt and Verde River watersheds. 2. To develop techniques and procedures for systematic monitoring of snowcover and moisture conditions using remote sensor methods together with the use of the ERTS data collection system to relay ground truth data in near-real time.

The ERTS-1 and NOAA-2 imagery will be the primary source of repetitive remote-sensing data over central Arizona for obtaining snow-covered areas on the Salt and Verde River watersheds. These data will be supplemented by repetitive aerial surveys and supporting ground truth relayed by the ERTS DCS. The ERTS data collection platforms will relay hydrologic and meteorological data from key locations to aid in interpretation of the imagery and to demonstrate the ability of the relay system to furnish timely and meaningful hydrologic information for use by water management.

The feasibility of using satellite telemetry for the relay of hydrologic data in near-real time was demonstrated during the floods of March 1978. The SMS/GOES data-collection system was used to furnish streamflow and hydrometeorological data to the Salt River project in Phoenix near-real time to assist in reservoir operations. The hydrometeorological streamflow-prediction model (HM) was modified and tested for use on the Salt-Verde watershed in central Arizona.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0023, AIRCRAFT MEASUREMENT OF PLUME DISPERSION AND CHEMISTRY

D. Blumenthal, Meteorology Research Inc., *3401 Mendocino Ave., Santa Rosa, California* 95401 (68-02-2713; G603A-AA-107)

OBJECTIVE: To acquire a data base necessary for the development of control strategies for the reduction of ambient air concentrations of sulfates and nitrates.

APPROACH: Large scale, discrete, intensive experimental field studies will be conducted. Aircraft measurements of SO2, O3, bscat, NO and NO2 will be made and integrated samples will be collected for aerosol size distribution and composition.

PROGRESS: Field collection completed. Samples are being analyzed and data reduced.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Sciences Research Lab.

5.0024, THERMONIC HEAT EXCHANGER (THX) DEVELOPMENT

N.J. Rasor, Rasor Associates Inc., *420 Persian Dr., Sunnyvale, California* 94086 (HT-01-01; EY-76-C-02-2263.A005)

To do research to determine the feasibility of adopting thermionic conversion technology, developed for use in the space nuclear power program to terrestrial electrical program. Design and test a THX cell. Initiate systems analysis of THX topping of fossil fuel fired electric plants.

SUPPORTED BY U.S. Dept. of Energy, Office of Fossil
Energy

5.0025, SEASAT PROGRAM - INTEGRAL INVERSION OF SEASAT - COMPARISON OF DERIVED SWELL AMPLITUDES & RMS WAVEHEIGHT WITH SURFACE TRUTH (ABBREV)

B.J. Lipa, S R I International, Remote Measurements Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (7-923; MO-AO1-78-00-4319)

OBJECTIVE: Develop a integral inversion technique which when applied to Seasat Altimeter data will give the functional form of the ocean surface height probability density.

APPROACH: The derived probability functions will be interpreted in terms of swell amplitude and from waveheight of wind-derived waves. These results will then be compared with surface truth measurements obtained in the Joint Air-Sea interaction (JASIN) experiment and the Gulf of Alaska experiment.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0026, STUDY OF AEROSOL EFFECTS ON SOLAR RADIATION USING LIDAR AND AN INSTRUMENTED TOWER

P.B. Russell, S R I International, Atmospheric Sciences Laboratory, *300 Ravenswood Ave., Menlo Park, California* 94025 (ATM78-02704)

The objectives of this study are to improve our understanding of the role of aerosols in modifying climate. This will be achieved by monitoring the changes in the atmospheric albedo while simultaneously documenting particle concentrations and characteristics. Radiative models will be used to interpret the measurements.

The study includes continuous measurements of upward and downward solar irradiance above the urban-coastal haze layer using a unique tower facility at Sutro Tower, lidar documentation of haze structure, numerous radiometric measurements near the surface.

The plan includes two field programs at the Sutro Tower and adaptation of an advanced radiative transfer code for simulation of measured incidents. It also includes participation in a joint marine field program with the University of Arizona. At the end of the two-year program all measurements and analyses will be unified in terms of aerosol models and parametric radiative effects that will be published in a form readily usable by other climate modelers.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0027, OCEAN SURVEILLANCE USING PASSIVE RADIOMETRY

N.R. Ortwein, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Surface & Aerospace Surveillance Dept., *San Diego, California* 92152 (DN887530)

Examine existing empirical data and literature to determine the uses of passive detection of submerged objects and floor features from above the ocean surface, using solar illumination.

Task 1 - obtain information on the inherent limitations of visible and near IR data gathered by optical instruments over water, as used in the NASA ERTS series of satellites. This shall include a determination of measurement limitations due to instrument calibration, with allowance made for wavelength dependence. Task 2 - subcontract to visibility lab for preparation of all radiometry models developed to date that are relevant to assess detection of underwater objects using solar radiance. Supporting contractual data is reported under DN887546.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Material Command

5.0028, REMOTE SENSING OF INTERNAL WAVES

R.R. Buntzen, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Systems Analysis Office, *San Diego, California* 92152 (DN987526)

To measure and correlate ocean internal wave motion with fluctuations in the upwelling light field; to separate and understand the origins of the surface and subsurface components of the light field observed.

A controlled experiment will take place at the NOSC tower during the months of July and August. Instrumentration will consist of three thermistor chains (15-20 beads) to measure the amplitude and direction of internal waves, three 4-band spectroradiometers to measure change in the upwelling and downwelling subsurface light field, and a imaging spectroradiometer to monitor on the surface radiance. Support instrumentation will include a NADC/SIO spectral/transmissometer for determining water clarity versus depth, a profiling fluorometer for chlorophyll and pigment determination and a conductivity-depth-temperature probe (CDT) for measuring density and hence Vaisala-Brunt period and finally internal wave modes present. Data would be recorded on magnetic tape and reduced on the NOSC UNIVAC 1110 computer. Analysis and report preparation would follow.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Material Command

5.0029, VIKING - PHYSICAL PROPERTIES

H.J. Moore, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9580-00734)

Data on the physical properties of the surface materials collected by the two Viking landers on Mars show that there are four distinct kinds of surface materials. They are, in order of increasing strength: 1. cross-bedded drift material at the Lander 1 site, 2. platy to crusty 'soil' at the Lander 2 site, 3. cloddy to rocky 'soil' at the Lander 1 site, and 4. rocks at both sites. Cohesions, angles of internal friction, and other physical properties are currently being analyzed using surface sampler data and camera pictures obtained during both the Primary and Extended Viking Missions.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0030, MERCURY RESOURCE APPRAISAL

E.H. Bailey, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Western Mineral Resources, *345 Middlefield Rd., Menlo Park, California* 94025 (9320-02008)

Continuing to gather mercury resource data of all kinds in field and in office. Maintain CRIB mercury data file, office file, research collection of specimens from mercury deposits of world.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0031, EVOLUTION OF THE THARSIS REGION OF MARS

M.H. Carr, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02375)

The objective is to understand the nature and history of the Tharsis anomaly on Mars. Tharsis is at the center of a 7 km high bulge in the Martian crust. Fractures associated with the formation of the bulge have affected an entire hemisphere of the planet and the most prominent volcanic region of the planet is at its center. The project aims at determining when the bulge started to form, whether its growth was continuous or episodic, how the growth correlates with the associated volcanic activity and when its vast radial fracture system formed.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0032, FAULTS AND OCCURRENCES OF GEOTHERMAL ANOMALIES

G.C. Brogan, Woodward & Clyde Consultants, *P.O. Box 1149, Orange, California* 92668 (14-08-0001-16310)

STATE TO WHICH PROJECT PERTAINS: California.

The objective of this research is a generic study of faulting in relation to hydrothermal systems. Attributes of faults and hydrothermal systems will be investigated in order to identify differences in the character and genesis of faults that pass through a hydrothermal reservoir, bound a hydrothermal reservoir, influence the heat source, define the geothermal province boundaries and relate the province to large-scale regional features. Differences between faults or fault segments, and diagnostic features of faults in various functional relationships with respect to the reservoir will be determined primarily by cataloging fault characteristics and geothermal data in a special purpose, computer data base that can be used to highlight general associations. Faults will be located for field study by low-sun-angle aerial photography, other remote sensing imagery and information on fault distribution in relatively well-studied areas. Field investigations in three to five study areas will include excavation of trenches across fault alignments. It will emphasize evaluation of absolute and relative age of faults, fault characteristics, and mineralogic and chemical concentration gradients.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0033, NATIONAL AEROMAGNETIC SURVEY

R.H. Godson, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9730-00352)

The project will publish updated publication lists by state of aeromagnetic and aeroradioactivity maps and reports. Administration and monitoring of new contracts to private industry for airborne surveys will continue. A computer data base of principal facts of airborne surveys will be established. Work will be started on compiling state wide maps of Alaska and Hawaii in color.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0034, LIGHT AIRCRAFT PHOTOGRAPHY AND MAPPING RESEARCH

R.L. Parker, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9350-00800)

This project seeks to develop techniques of aerial photography using small-format cameras, and of aerial geologic reconnaissance in order to assist geologic mapping and mineral resource investigations. Currently a T-41B is being used to fly 70-mm cameras for both vertical and oblique photography using color and black-and-white films. Projects supported are primarily resource studies in the Rocky Mountain states.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0035, REMOTE SENSING FOR URANIUM EXPLORATION

G.L. Raines, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046 MS939, Denver Fed. Ctr. Bldg. 25, Denver, Colorado 80225 (9790-01706)*

STATES TO WHICH PROJECT PERTAINS: Wyoming, Utah, New Mexico, and Colorado.

The primary objectives for this year are (1) to extend the types of analyses performed in the southern Powder River Basin to the rest of the basin and, hopefully, to define new areas within the area with uranium potential, (2) to further refine the analysis of the aircraft data as a uranium alteration mapping tool, (3) to complete the analysis of the enhanced images of the southern two-thirds of Utah in preparation for the pattern recognition study, and (4) to start processing Landsat data for an analysis of the San Juan Basin.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0036, PROJECT MAGNET UPGRADE OF SAMPLING RATE SELECTOR

R. Laurenson, U.S. Dept. of Defense, Navy, Naval Oceanographic Office, *Washington, District of Columbia* 20390 (DN881530; N62269-78-WR-00494)

Upgrade airborne project MAGNET instrumentation to facilitate data collection at a higher sampling rate. This work supports work unit ZU701, Accession No DN681083.

Project MAGNET data collection system hardware is being modified so that higher sampling rates can be implemented quickly and efficiently through use of a front panel selection switch. (Previously any change in sampling rate required extensive internal hardware manipulation.)

SUPPORTED BY U.S. Dept. of Defense, Naval Air
Development Center, Sensors & Avionics
Tech Directorate

5.0037, MARINE AEROSOLS

L.H. Ruhnke, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880226)

The objective of this research is to improve prediction of vertical distributions of marine aerosol size spectra. Microwave radiometric data from satellites will be used to derive whitecap conditions which are believed to relate well to the aerosol generation rate at the sea surface. In conjunction with satellite-derived wind data and turbulence models, the capability to predict optical and IR propagation properties in the marine boundary layer will be increased.

An initial theoretical model of the vertical distribution of aerosol size spectra will be constructed utilizing current knowledge of white water production, turbulent mixing processes, particulate fall speeds, the cloud physics of salt particles and computer techniques. This model will be field tested in the MARSEN I experiment where surface meteorological and aerosol measurements can be obtained under severe weather conditions from fixed towers in the North Sea.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

5.0038, RESPONSE OF A WESTERN BOUNDARY CURRENT IN THE GULF OF MEXICO TO WIND FORCING

W. Sturges, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Oceanography, *205 Wildwood Dr., Tallahassee, Florida* 32306 (OCE78-20722)

This project is a combined field and analysis study of the response of currents in the western boundary region in the Gulf of Mexico to the seasonally varying wind forcing. The effort is a continuation of a previous study addressing similar questions but involving the analysis of existing data sets. The field effort involves a current meter and temperature sensor array which will be deployed for a nine-month period. In addition satellite data and hydrographic data taken by ships and aircrafts will be used to track eddies from the Loop Current as they enter the western boundary region. The overall experimental design attempts to resolve changes in the boundary current from effects caused by Loop Current eddies.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Ocean Sciences

5.0039, GEOCHEMISTRY OF LUNAR AND PLANETARY PROCESSES

J.A. Philpotts, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Geology & Geophysics, *2444 Dole St., Honolulu, Hawaii* 96822 (EAR79-06950)

This investigation is a continuation of work previously funded by NASA but transferred to NSF. The goal of this research is to gain understanding of the igneous differentiation of the Moon and planets. Specific objectives are (1) to study kinetic effects on lithophile trace element liquid-solid partitioning in rapidly cooled mare basalts in order to understand the nature and magnitude of these effects and be able to take them into account in estimating equilibrium partition coefficients–isotope dilution analyses on separates and microprobe analyses of thin sections will be performed, (2) to obtain 'corrected' partition coefficients from porphyritic lunar rocks, and from lunar mineral-whole rock values given in the literature, for use in differentiation models, (3) to undertake a review and synthesis of information on the igneous evolution of the Moon. Another set of objectives are (4) to see if ash deposits are as useful as are lavas as signatures for individual volcanoes, (5) to examine changes in lava composition of a volcano with time, (6) to examine temporal and spatial changes in geochemical activity of a hotspot, (7) to investigate the origin of silicic rock in a tholeiitic basalt section. These latter objectives will be met by analyzing Hawaiian volcanics for lithophile trace element abundances and for major elements by electron microprobe.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0040, DELINEATION OF MINERAL BELTS BY SATELLITE AND GEOPHYSICAL REMOTE SENSORS

D.W. Levandowski, Purdue University, School of Science, Dept. of Geosciences, *Executive Bldg., West Lafayette, Indiana* 47907 (XR0406)

The overall objective of this research is the development of a Landsat-based methodology for aiding the reconnaissance phase of exploration for mineral resources. Specifically, the main objective is to develop and apply methods of combining geological, geophysical and geochemical information together with Landsat data to assist in delineating and mapping mineral belts.

The research will consist of establishing geological and geophysical features of mineral belts and determining the spectral and spatial characteristics of Landsat data that reflect these features. The major portion of the research will consist of examining in detail well established mineral belts (Colorado and Montana-Idaho) and systematically developing the criteria for delineating them. Particular emphasis will be given to using preprocessed Landsat data for the mapping of structural and lithologic features. Manual comparison of these features along with computer-aided statistical studies will be used to establish the correlation between geological and geophysical features with the Landsat derived features.

The procedures and techniques developed will then be applied to a test area to determine if an extension of the Colorado mineral belt exists in Arizona.

SUPPORTED BY Purdue Research Foundation

5.0041, EOMET AND MARINE FOG FIELD INVESTIGATIONS IN THE GULF OF MEXICO

J.B. Russell, U.S. Dept. of Defense, Navy, Naval Avionics Facility, *Indianapolis, Indiana* 46218 (DN797002)

To investigate the atmospheric marine boundary layer in order to provide an understanding of its influence on the propagation of electromagnetic radiation and on the formation, maintenance, and dissipation of marine fog.

Meteorological, micrometeorological and microphysical measurements in the marine boundary layer, as well as oceanographic measurements, will be made. Measurements will be made from fixed platform, ship and aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

5.0042, N.E. REGIONAL OXIDANT STUDY FIELD SUPPORT

C.R. Dickson, U.S. Dept. of Energy, Ames Lab., *Ames, Iowa* 50010 (D9-X0348; G603A-AD-033)

OBJECTIVE: The objective of this effort is to obtain additional upper-air observations; continuous airborne measurements of ozone and meteorological parameters, and to follow an air-parcel using tetroons.

APPROACH: The National Weather Service will make additional radiosonde observations at the existing upper-air stations; a specially instrumented research aircraft will be used to make the airborne observation, and the tetroons will be tracked using a mobile radar system.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Research Information
Center

5.0043, LASER HYDROGRAPHY DEVELOPMENT

D.B. Enabnit, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Ocean Survey, Engineering Development Lab., *6001 Executive Blvd., Rockville, Maryland* 20852 (86221700)

OBJECTIVE: Validation of the capability of an airborne laser system to meet the vertical requirements of NOS, and determination of the cost effectiveness and associated optimum prototype system configuration which best meets NOS' requirements.

APPROACH: The first objective will be addressed by field testing the NASA Airborne Oceanographic Lidar (AOL) as an 'engineering model' laser depth sounder. The second objective will be met by doing a conceptual design and performing a cost benefit analysis to determine cost per unit area of airborne hydrography.

PROGRESS: Evaluation of the data collected during the field testing is in progress. Comparisons between laser bathymetry and sonar bathymetry have been made to statistically estimate accuracy of the laser system. Effort is being placed in the quantification of biases produced by laser pulse power loss and pulse stretching in the water. Techniques for correcting laser soundings for surface wave effect and improving measurement precision of aircraft attitude have been developed. There still exists a bias in the AOL data that has not been accounted for but since it is predictable, it can be accounted for in any operational system.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Environmental
Data Information Service

5.0044, SENSOR DEVELOPMENT FOR BASIC SURFACE OBSERVATIONS - VISIBILITY

D.T. Acheson, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service, Systems Development Office, Equipment Development Laboratory, *8060 13th St., Silver Spring, Maryland* 20910 (8AA81024)

OBJECTIVE: To develop a visibility sensor to accurately measure the atmospheric extinction coefficient. From this quantity, runway visual range (RVR), runway visibility (RVV) and other closely related measures of visibility are easily computed. The sensor should be capable of measuring visibility over the range of 0.1 to 10 kilometers.

APPROACH: 1. Evaluate the EG&G Forward Scatter Meter. 2. Investigate laser backscatter devices as candidate prevailing visibility sensors.

PROGRESS: Telephotometer is being fabricated. EG&G Forward Scatter Meters borrowed from FAA are being modified by manufacturer. Delivery is expected in January.

SUPPORTED BY U.S. Dept. of Commerce, National Weather
Service, Systems Development Office

5.0045, SEASAT PROGRAM - 'OCEANOGRAPHIC STUDIES USING SEASAT-A ALTIMETRIC DATA'

C. Wunsch, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (K7-971; MO-A01-78-00-4327)

OBJECTIVE: Seasat-A altimetric data, will be combined with (1) a priori geoids determined by satellite orbit analysis and shipboard gravity measurements, (2) the known spectrum of the sea surface currents, and (3) the known hydrographic field of the ocean, in an inverse solution for an improved geoid and a determination of ocean circulation.

APPROACH: The application of altimetric data from Seasat-A to geophysical and oceanographic problems involve simultaneously dealing with a satellite ephemeris, the geoid, ocean circulation, and associated phenomena.

The primary interest in physical oceanography will be to determine the open-ocean circulation on a global basis, with a long-term goal to obtain the general circulation (the averaging time to be defined) the long-term fluctuations, the large-scale (mesoscale) variability, and, ultimately, the dynamical relationships among these flows.

The geodesy goal is to obtain the ocean geoid and the mean sea-surface topography (i.e., the difference between the precise satellite-to-sea-surface altimeter measurements, surface-gravity data, and a geopotential model expressed in spherical harmonics derived from satellite perturbation analysis.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0046, SIMULTANEOUS MEASUREMENTS OF HYDROGEN AND OXYGEN EXOSPHERIC TEMPERATURES

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Two outstanding problems in our understanding of the planetary exospheres are intimately tied to a knowledge of the (line) profiles of the geocoronal hydrogen emissions: The extent to which particles in 'satellite orbits' are present; and the degree to which a non-thermal component of escaping hydrogen may be present. An accurate spectral line shape measurement of the geocoronal hydrogen emissions addresses these questions. From the doppler line profile, one can also determine the temperature associated with the emitting region. A precise and accurate measurement of the temperature in the exosphere of the earth is important for understanding the planetary escape of light gases and for modeling the atmosphere which lies below the exobase. The escaping gases, primarily hydrogen, are expected to undergo evaporative cooling, and create an exosphere in which each species has a slightly different temperature. As a direct consequence of this cooling, the escape rate of light gases will be reduced resulting in an increase in the thermospheric content of hydrogen (and a reduction of the altitude where the flux limit occurs). A further effect is that the measure of exospheric temperature of hydrogen is not a direct measure of the temperature of the major constituent gas.

This grant funds an attack on these problems by allowing, for the first time, simultaneous measurements of the exospheric hydrogen temperature and the thermospheric temperature of the major gas, oxygen. The program will be carried out at Arecibo, which is unique for this purpose.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0047, NO/NO2 MEASUREMENTS IN SUPPORT OF ACID PRECIPITATION EXPERIMENT (APEX)

D.H. Stedman, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Oceanic Science, *Ann Arbor, Michigan* 48104 (ATM7819250)

The acid precipitation experiment (APEX) is a collaborative effort among NCAR and several universities with the goal of exploring, by aircraft experiments, the air chemistry underlying acid precipitation on a regional scale. This grant supports measurements of NO and NO2 during APEX. These NOx species are precursors of HNO3, an important constituent of acidic precipitation. An NO/NO2 analytical system will be installed aboard the research aircraft, and data will be collected and analyzed to explore the interrelationship among the oxides of nitrogen, HNO3 concentrations, O3 concentrations, and solar flux. In addition to providing new insight into the role of NO and NO2 in the air chemistry of acid rain, the data will be a significant direct addition to knowledge of tropospheric concentrations of nitrogen oxides.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0048, ISOTOPIC AND GEOCHEMICAL STUDIES OF LUNAR SAMPLES AND DIFFERENTIATED METEORITES

V.R. Murthy, University of Minnesota, Minneapolis Campus, School of Earth Sciences, Dept. of Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR79-06769)

This study is a continuation of investigations, previously supported by NASA, which have been transferred to NSF. The work deals with three specific projects: (1) the magnetic history of the moon in the period 4.5-4.0 AE ago by studies of non-mare melt rocks, (2) Rb-Sr, Sm-Nd and 40 Ar-39Ar studies of the silicate fractions of differentiated meteorites such as mesosiderites and IAB iron meteorites, and (3) considerations of the lunar initial strontium ratio by studies on Rb-poor, Sr-rich feldspathic highland rocks. The overall objectives are to understand the early planetary evolution of differentiated meteorites and the possible relationships between them.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0049, INSTRUMENTATION DEVELOPMENT FOR HYDROLOGIC DATA COLLECTION

F.C. Koopman, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *NSTL Station, Bay St. Louis, Mississippi* 39520 (SR 54-141)

New developments in equipment and instrumentation suitable for use in water resources investigations, surveys and research need to be evaluated. Advances in electrical, electronic, and mechanical devices and components should be investigated.

Instruments or systems needed for WRD data collection are usually very specialized and so limited in number that industry enthusiasm and accomplishment fails to satisfy these needs. Therefore it is the objective of this project to design devices and systems which satisfy field requirements for new, special or improved instrumentation.

The technology developed for each project or device is open for group and individual review prior to final method selection. After this selection maximum emphasis is directed toward operational reliability with minimum visitation and maintenance. Both method selection and development decisions are governed by practical techniques for accuracy, power conservation, longevity and overall economy.

Fifty-seven water quality monitors (WQM) were tested and distributed. Fifteen units were designed and assembled to interface with a magnetic-flow meter for recording flow on a digital recorder. A mini-servo control unit was designed and proven reliable for production. A current meter digitizer for replacement of earphones and stopwatch was prototyped and ten experimental units furnished to districts. Two systems were built for the Ohio River locks and dams for monitoring flow controls. Calibrations and repairs were made on 300 meters. Maintenance was conducted for the satellite relay program. The Denver Training Center was assisted. The laboratory maintained liaison with agencies and commercial concerns on hydrologic instrumentation.

Design, assemble and install flow-through monitor systems. Investigate, develop, design and improve signal conditioning circuits for interfacing hydrologic sensors to recorders. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0050, IMPROVEMENT OF REMOTE SENSING TECHNOLOGY RESEARCH APPLIED TO LAND RESOURCE ANALYSIS

D.J. Barr, University of Missouri, Rolla Campus, School of Mines & Metallurgy, Dept. of Mining Petroleum & Geological Engineering, *Rolla, Missouri* 65401 (SER77-06848)

The proposed project will provide the instrumentation, graduate student support, and research climate for improving the application of remote sensing technology to the solution of land resource allocation problems. Research into methods of detecting, delineating, and/or monitoring of land use, mineral and energy resources, agricultural, forest and range resources, water resources, reclamation, and environmental quality will be improved and enhanced. Satellite and aircraft image processing equipment will be procured and integrated into the existing remote sensing laboratory. Graduate research opportunities will be provided along with seminars for exchange of research ideas, problems, and results among researchers from a variety of science and engineering disciplines.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div. of Science Education Resources Improvement

5.0051, TROPHIC CLASSIFICATION OF ILLINOIS LAKES

D.H. Boland, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J613B-024)

OBJECTIVE/APPROACH: The general objective is to classify Illinois lakes according to trophic state using LANDSAT multispectral scanner data in conjunction with water quality data collected by the National Eutrophication Survey. Specific objectives include: 1) ranking of Illinois lakes as to Secchi depth transparency, 2) ranking of lakes according to chlorphyll A levels, 3) ranking of lakes according to a trophic index, and 4) compilation of lake surface area estimates. Statistical relationships between water quality data from Illinois lakes sampled by the National Eutrophication Survey and LANDSAT multispectral data for the same lakes will be examined. If significant relationships are found, models will be developed to estimate the magnitude of the trophic indicators and the trophic index in the NES lakes. The models will then be used to estimate the parameter values in the remaining Illinois lakes.

FINAL OUTPUT: A report will be published describing the project's results and, including the ranking, will be used by Region V & Illinois water quality managers.

PROGRESS: Comparison of LANDSAT and contact data trophic rankings, Secchi depth, and chlorophyll A were quite successful. Interpolation for lakes not originally contact sensed was good; however, extrapolation to Secchi depth and chlorophyll A values beyond those originally used to establish algorithms was less successful. Clusters of lakes provided by the algorithms appeared to correspond to groups of lakes having many natural properties in common. Project report 'Trophic Classification of Illinois Water Bodies' has passed technical review.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Systems Lab.

5.0052, DEVELOP ADVANCED TECHNIQUES FOR TROPHIC CLASSIFICATION OF LAKES AND ASSESSING ESTUARINE AND WETLANDS AREAS

V.W. Lambou, U.S. Environmental Protection Agency, Office of Research & Development, Environmental Monitoring & Systems Lab., Water & Land Quality Branch, *P.O. Box 15027, Las Vegas, Nevada* 89114 (J884A-027)

OBJECTIVE/APPROACH: The objective is to develop a method to assess lacustrine trophic state and land use impact on lakes through a combination of satellite and aircraft multiscanner data and in situ data. The development and verification of such a system is being cooperatively pursued by EMSL-LV and NASA's JPL at Pasadena. Ground truth (in situ) data are being obtained through cooperative efforts with EPA Regional, State, and other Federal agency personnel. Construction of algorithms, overflight data acquisition and computer processing are being conducted by JPL-Pasadena. Data analyses and interpretation is accomplished jointly.

OUTPUTS: A report on the results obtained will be published. A second report describing the methodology, developed software, and other operational details will also be published to provide an operational monitoring tool for assessment of lake water quality by Federal, State, and other interested organizations.

PROGRESS: Collection of contact sensed data by cooperating Agencies personnel is being conducted. LANDSAT scenes for the appropriate data have been ordered, and data processing has begun.

SUPPORTED BY U.S. Environmental Protection Agency,
Office of Research & Development,
Environmental Monitoring & Systems Lab.

5.0053, REMOTE SENSING APPLICATIONS FOR THE ANALYSIS AND MANAGEMENT OF RENEWABLE NATURAL RESOURCES

P.T. Tueller, University of Nevada, Reno Campus, School of Agriculture, Dept. of Renewable Natural Resources, *Reno, Nevada* 89507 (177771 (HRB NO.))

To investigate remote sensing techniques for application to natural resources management including range, forestry, wildlife, watershed, outdoor recreation and crop agriculture. Test techniques for vegetation mapping, wetland inventory, range condition and trend, erosion evaluation, and economic value. Assess site biomass and production, land use mapping and classification. Conduct resource inventories and serve as a repository for remote sensing data. APPROACH: Various scales (1:600 to 1:1,000,000) of color and color infrared types along with actual ground data, densitometers, and field averaging spectrographs will be used to identify phenomena relative to subjects being investigated. Accepted and experimental techniques and procedures will be used and evaluated. Computerized imagery from Land Set I and II will be evaluated. In all cases applications will be emphasized.

SUPPORTED BY University of Nevada

5.0054, UPGRADING OF TWO SOLID-SOURCE MASS-SPECTROMETERS TO STATE-OF-THE-ART INSTRUMENTS

R.K. O'Nions, Columbia University, School of Arts & Sciences, Dept. of Geological Sciences, *Broadway & W. 116th St., New York, New York* 10027 (EAR78-25197)

It is proposed to substantially improve the abundance sensitivity of the MM-30 by the addition of a commercially available electrostatic analyzer (energy filter) which is complete with a Faraday and Daly detector and to purchase a high voltage supply and electronics for the Daly scintillation detector. The current Faraday collector and Daly, which will be released from the Micromass 30 when the proposed changes are made, will be used to replace the collector on the Lamont 12' mass-spectrometer and provide the much needed improvement in detector sensitivity required on this instrument.

The instruments will be used in the following studies: 1) Oceanic Basalts and Ultramafic Nodules; 2) Evolution of Archaean Crust; 3) Oceanic Ferro-manganese deposits; and 4) Meteorite Studies.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

5.0055, PETROLOGY OF THE ORDINARY CHONDRITES

R.T. Dodd, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (EAR79-23850)

This is a renewal grant of investigations carried out on the systematic petrology of ordinary chondritic meteorites (EAR7421801). The petrology of the ordinary chondrites will be studied in order to provide information on the pre- and post-accretionary histories of these meteorites. Specific tasks to be undertaken in this study include: 1. chemical and petrographic study of chondrules in type 3 ordinary chondrites to assess the roles of fractional vaporization, reduction, and sampling of precursor rocks in their chemical differentiation; 2. study of the L-group chondrites to investigate the major element variations within this group of meteorites; and 3. determination of the metamorphic histories of the L-group chondrites.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0056, GOES SATELLITE RESEARCH PROJECT, JUNIATA RIVER BASIN, PENNSYLVANIA

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An automated hydrologic data collection-processing system is needed to provide users with processed data which is essentially real time and independent of manually collected data tapes.

To evaluate the Geostationary Operational Environmental Satellite (GOES) system, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Select 20 sites for upcoming COMSAT general proposed pilot project and brief cooperators and District personnel on the COMSAT system.

To install CDCP's water level sensors at nine of 14 gaging stations currently being operated in the basin and attempt to manage the stations based on data coming through the GOES system. Develop viable analysis and processing techniques using GOES-collected data. Meet with COMSAT personnel and cooperators for exchange of information regarding the COMSAT system operational features, site selection, and data format, needs, and availability.

All CDCP's were returned twice for factory modification and installed in the field. Data was monitored almost daily. Six technicians were trained in CDCP operation. An unpublished report on CDCP Operation for a one-year period was completed and submitted to the Chief, Data Relay project. Data for five COMSAT DCP's was monitored almost daily for an eight-month period after which DCP's and associated hardware were removed. A performance report was prepared by COMSAT General and a performance summary was prepared by the Chief, Data Relay project.

Continue to evaluate the geostationary operational environmental satellite (GOES) system, determine the reliability of the convertible data collection platform (CDCP) and associated hardware, and demonstrate usefulness of data processing through the system. Meet with COMSAT personnel and cooperators to select 20 sites for upcoming proposed COMSAT General pilot project. Perform necessary field reconnaissance at each site.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0057, RESEARCH AIRCRAFT PROGRAM

T.V. Crawford, E.I. du Pont de Nemours & Co. Inc., *P.O. Box A. Aiken, South Carolina* 29801 (976; AT(07-2)-1)

The objectives of this program are to provide research aircraft and data analysis support for the testing of atmospheric dispersion models. The data bases will include: the concentration of pollutants in the atmosphere surrounding SRP measured by the aircraft; pollutant concentration data from ground and tower sampling stations; the release rate of pollutants from the plant stacks; and all relevant meteorological data from the plant towers, the WJBF-TV tower, the National Weather Service, and other sources.

SUPPORTED BY U.S. Dept. of Energy, Office of Health &
Environmental Research

5.0058, NATIONAL PARK SERVICE COOPERATIVE PROJECTS

D.T. Lauer, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, EROS Data Center, *Sioux Falls, South Dakota* 57198

To (a) generate by means of remote sensing resource inventory information useful for the development of a General Management Plan over park areas, (b) evaluate accuracy levels, time and costs associated with obtaining resource information using remote sensing techniques, (c) train NPS personnel to understand the advantages and limitations of remote sensing technology applied to resource inventory, monitoring, and assessment problems, and (d) report on the methodology, results, and applicability of remotely sensed data used for national park planning and management purposes.

SUPPORTED BY U.S. Dept. of the Interior, Land
Information & Analysis Office, EROS
Data Center

5.0059, EFFECTS OF THE INTERPLANETARY MAGNETIC FIELD ON THE DAYSIDE MAGNETOSPHERE

J.L. Burch, University of Texas, San Antonio Campus, School of Science & Mathematics, Dept. of Earth & Physical Science, *San Antonio, Texas* 78285 (ATM78-26762)

The objective of this research is to investigate the coupling of solar-wind energy and momentum into the magnetosphere by determining the effects of the interplanetary magnetic field (IMF) on dayside plasma convection and particle precipitation. The investigation will contribute to the International Magnetospheric Study since it will utilize simultaneous measurements from Atmosphere Explorer D and either Imp 7 or Imp 8 from the early part of 1976. Variations in the solar-magnetospheric x, y, and z IMF components will be investigated separately to determine their effects on the topology of polar-cusp magnetic field lines, on the patterns of dayside plasma convection, on dayside particle acceleration processes, and on interhemispheric asymmetries of these phenomena. The overall aim is to understand magnetosphere dynamics in response to solar inputs.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0060, CORPS OF ENGINEERS REMOTE SENSING COMMITTEE

K.T. Yoritomo, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (31642)

OBJECTIVES: The objectives of the Committee are to continually evaluate the state-of-the-art; provide technical assistance; disseminate remote sensing information; coordinate institutional arrangements; determine remote sensing data processing, handling, and storage requirements; and to determine Corps remote sensing user requirements, recommend priorities, and where possible, seek to assure that NASA's and other agencies' developmental systems respond to Corps needs.

APPROACH: The Committee meets twice each year to review remote sensing technology and to discuss its application to Corps of Engineers projects. The Committee recommends priorities for expenditure of remote sensing R&D funds. The Committee also supports training and the dissemination of remote sensing information.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers,
Engineer Topographic Lab.

5.0061, NATIONAL ENVIRONMENTAL OVERVIEW PROGRAM

J.B. Epstein, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9510-01593)

The National Environmental Overview Program summarizes characteristics and geographic distribution of earth materials and nature and extent of geologic processes in the United States. Maps at a scale of the National Atlas (1:7,500,000) will be major products, although larger scale maps have been and will be prepared. The maps and reports will provide a geologic data base useful to the understanding of environmental problems on a national scale and will be useful for generalized decision making on land use, energy and mineral resource development and their environmental impact, and public health. While maps at this scale probably cannot solve specific problems, they will identify the problems and point out critical areas of potential geologic constraints and guide future topical research.

The program includes preparation of the following maps at 1:7,500,000: landslides, surficial materials, volcanic hazards, active faults, surface water availability, karst and its engineering problems, swelling clays, bedrock lithology, nuclear reactor sites and their geologic problems, density of fault, areas of coal strip mines, Quaternary Dating techniques, radioactive waste management sites, engineering geologic map of the United States, impact structures, and carbonate for SO2 scrubbing. A quaternary map of the United States (1:1,000,000 and 1:2,500,000) and various environmental and engineering geology derivative maps will be prepared. A data file, allowing the retrieval of many items shown on published geologic maps is being prepared.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0062, METALLOGENIC STUDIES

P.W. Guild, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (9340-00244)

Continue assembling mineral deposit data for North America; plot data on map at 1:5,000,000, together with geologic/tectonic information, for visual analysis of their metallogenic significance, delineation of provinces and epochs, and their possible relationship to other events in earth history (particularly global tectonics). Enter data into computer storage for machine analysis in the future. Stimulate, maintain contacts with similar efforts on other continents.

Simplify, plot the data at 1:10,000,000 for the Circum-Pacific Minerals Map of NE Quadrant; advise on assembly and plotting of minerals data for the remaining quadrants (including Antarctica); codify the data for computer storage, retrieval, and analysis.

Maintain contact with IGCP Project 'Remote Sensing and Mineral Exploration', based on Landsat imagery and mineral deposit data; a principal objective is to evaluate the role of lineaments and circular structures in localizing mineral deposits.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0063, TRACE ELEMENTS IN PLANETARY MATERIAL BY ACTIVATION ANALYSIS

J.W. Morgan, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., MS 912, Reston, Virginia* 22092 (EAR79-11120)

This project is a continuation of studies previously supported by NASA but now transferred to the NSF.

Trace element analysis of planetary materials by activation analysis techniques will be carried out on a diverse set of extraterrestrial materials. The characterization, classification, and interpretation of meteoritic metal in lunar breccias and soils will be carried out in order to provide important information on the nature of the projectives which have formed these samples. The nature and distributions of volatile elements (primarily the platinum metals) in materials which have undergone shock by meteorite impact will be studied. The analytical data generated by this study will be used in modelling studies which are attempting to unravel the early and subsequent history of the planetary materials, e.g., meteorites, lunar samples, etc.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0064, SALINAS GEOPHYSICS

J.D. Phillips, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9730-02177)

States to which project pertains: New York, Pennsylvania.

Investigate the relation between surface lineaments seen in satellite imagery and subsurface structure in the Appalachian basin of central New York State and northern Pennsylvania, using aeromagnetic, gravity, seismic reflection, and deep well data.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

5.0065, COAST MARINE ADVISORY SERVICES - GRAYS HARBOR COLLEGE

J.M. Smith, Grays Harbor College, Undergraduate School, *Aberdeen, Washington* 98520 (A/FP-5)

OBJECTIVES: Provide education and information programs responsive to the needs of the marine resource users of the Washington coast region (Grays Harbor and Pacific counties). 1. Offer short courses, workshops, and an annual marine technical conference in response to needs identified by the local marine community. 2. Provide information and announcements to fishermen and coastal citizens through The Harbor Tides newsletter. 3. Assist the NWS in disseminating infrared satellite data to fishermen in Washington off-shore waters. 4. Provide public marine education programs through Coop. Extension, 4-H, and local school districts. 5. In cooperation with County Extension, develop use of shrimp wastes for agricultural fertilizer by working with shrimp processors and farmers.

ANTICIPATED BENEFITS: 1. The short courses and workshops seek to increase the ability of commercial fishermen and charterboaters to be effective harvesters and businessmen. The marine technical conference provides information to improve fishing operations (fishing gear, boat safety, electronics, etc.). 2. Harbor Tides disseminates information useful in addressing the development and improved use of local marine resources. 3. The availability of infrared satellite data will allow fishermen to reach fishing grounds sooner and to consume less fuel in finding and maintaining contact with school of fish. 4. The availability of public marine educational programs can increase the awareness, knowledge, and appreciation of local people for local marine environment. 5. Using shrimp wastes on dairy farmlands can increase farm productivity while reducing farm and shrimp processor costs.

IDENTIFIED BENEFITS TO DATE: 1. Improved relationships between the commercial fishermen and the National Weather Service has provided more useful weather broadcasts for local fishermen and charterboat operators. 2. In 1976-77 conducted 5 workshops attended by 120 people. Assisted BVTI in holding this year's marine technical conference (see A/FP-6). 3. Shrimp processors and dairy farmers in the South Bend area started a cooperative program to utilize 400 tons of shrimp waste per year. 4. Provided assistance to the City of Cosmopolis which established a salmon rearing project in Mill Creek. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., Sea Grant Office

5.0066, ICE DYNAMICS

W.J. Campbell, U.S. Dept. of the Interior, Geological Survey, Water Resources Div., *Tacoma, Washington* (WR 70-058)

The ice dynamics project is concerned with studying the motion of sea ice, glaciers, and ice caps and the way in which these systems interact with the atmosphere and oceans. Recent numerical modelling of the atmosphere and oceans reveals that the least understood part of the water and heat budget of the earth is that taking place in polar regions. Recent theoretical work also indicates that the arctic ice cover may be a metastable or unstable system. Russian and American development in the arctic necessitates intense study of the region to avoid inadvertent, irreversible changes of the arctic ice pack, glaciers, and oceans.

(1) To create numerical models of the arctic and antarctic ice covers and oceans for a variety of different rheological assumptions concerning the ice pack; (2) to acquire data to test the numerical models of the arctic ocean and ice pack and the antarctic oceans and ice pack by directly participating in remote sensing and surface-truth experiments and from remote sensing polar-orbiting satellites; (3) to construct multi-dimensional, time-dependent models of glacier flow and to test them with observations of glaciers made within the state of Washington by project personnel and glacier data from other investigators in other nations; (4) to construct numerical models of water flow within

glacier and ice cap systems and to test these models with observations acquired from various glacier sites; (5) to study models of snow hydrology of alpine areas such as the North Cascades and Sierras.

The numerical models described above will be done using high-speed digital computers both within the Survey and at the U. of Washington. The field work in the polar regions will be done in direct cooperation with other agencies such as NASA, NOAA and DOE Canada, with whom the Ice Dynamics Project is in direct and intimate contact. This will include aircraft remote sensing using the NASA CV 990 airborne laboratory. Field work on glaciers will be done.

Continued work on an idea to replace the concept of eddy viscosity in fluid dynamics. A system for converting twice-daily Antarctic surface pressure data to air stress data on sea ice has been completed for application to a numerical model to describe Antarctic sea ice. A paper on the approximation of saturation vapor pressure has been completed. (Text Abridged)

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Water Resources Div.

5.0067, SEASAT PROGRAM - 'ENHANCEMENT OF SEASAT WIND-STRESS MEASUREMENTS USING DATA FROM GOES'

V.E. Suomi, University of Wisconsin, Madison Campus, Space Science & Engineering Center, *Agriculture Hall, Madison, Wisconsin* 53706 (7-974; MO-A01-78-00-4331)

OBJECTIVE: To resolve the ambiguity of the wind and stress measurements from the scatterometer and to improve their quality by using the cloud motion winds from GOES.

APPROACH: The principle involved is that low level cloud motions are highly correlated with surface winds over the ocean. Thus, cloud motion vectors can be transformed into estimates of surface winds with modification for boundary layer effects. These independent data can be used for selecting the correct scatterometer solution and providing quality control checks on the solution. Results expected from this program are improved data sets of sea surface stress or wind measurements. The approach to the problem will be to assume a value for the frictional wind changes below cloud base using tabulated data and any other pertinent literature. A second component of the wind changes will be calculated from the temperature gradients. These two corrections will be used to approximate the surface wind from the cloud motion wind and the closest scatterometer solution can then be selected.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic
& Atmospheric Admin., National
Environmental Satellite Service

5.0068, A SATELLITE STUDY OF MONSOON DISTURBANCES IN THE ARABIAN SEA AND THE BAY OF BENGAL DURING SUMMER MONEX

D.N. Sikdar, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Geological Sciences, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (ATM79-01981)

The objective of this grant is to provide support for the participation of the PI in the 1979 summer Monsoon Experiment (MONEX). MONEX is a regional subprogram of the Global Atmospheric Research Program. The summer phase of MONEX will take place from 5 May to 31 July 1979 and it will have two components; the Arabian Sea and the Bay of Bengal.

The PI will assist at the operations centers at Bombay (May and June) and Calcutta (July) primarily in analyses, forecasting and mission guidance activities. His work will support a large and complex U.S. research aircraft program. He will, in addition, be a research and mission scientist aboard the research aircraft.

Finally, a quick-look data set emphasizing dynamic and thermodynamic features of disturbances selected for intensive analysis in a later phase of this project will be prepared and made available to MONEX scientists.

MONEX is a major study to increase our knowledge and understanding of the dynamics and thermodynamics of the atmospheric and ocean in monsoon regions. MONEX is important scientifically and also has significance for global agriculture, economics and politics. The initiative for MONEX is from the Government of India with the U.S.S.R. and U.S.A. playing major roles. In addition to the benefits mentioned above, MONEX offers an excellent opportunity for scientific and technical cooperation between, and of mutual benefit to the U.S., India and the U.S.S.R.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0069, MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION

R. Reiter, Institut fur Atmospharische Umweltforschung der Fraun. Gesel, *Kreuzeckbahnstrasse 19 Frg, Garmisch Partenkirchen, Federal Republic of Germany* (P-02-78-0157; EY-76-C-02-3425)

The influx of stratospheric air into the biosphere is studied with the objective to obtain information about the frequency distribution of stratospheric intrusions as a function of seasonal and inter-annual variations. Stratospheric intrusions are indicated by high concentrations of the cosmogenic radionuclides Be7, P32, P33, and the ozone, measured at the mountain observatory Zugspitze (300 m a.s.l.). The transport of stratospheric air into the troposphere is determined on the basis of the isentropic trajectory analysis. The forecasting of stratospheric intrusions is performed based on observations of the variation of the relative humidity in the upper troposphere.

The quality of the forecasting technique is subjected to a statistical examination.

Aerosol layers in the stratosphere are measured by means of a lidar system.

RESULTS: It has been possible to prognosticate the fallout of the Chinese nuclear test of 25 September 1976. The forecasts of the influx intensity of stratospheric air into the biosphere came exactly true in 70% of the cases. The height of the stratospheric aerosol layer found changed during the period of observation.

SUPPORTED BY U.S. Dept. of Energy, Div. of Biomedical &
Environmental Research

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, CHARACTERIZATION OF SPACE ENVIRONMENT USING PLANT CELLS AND TISSUES

G.C. Sharma, Alabama Agricultural & Mechanical University, School of Agriculture, Dept. of Plant Science, *Normal, Alabama* 35762 (NSG 8067)

Characterization of space environment using plant cells particularly agronomically important cereals is the long-term objective of this study. Plant cells can be cultured in space with greater ease than animal cells. Earlier space investigations have concentrated more at the organismal level in higher plants than at the cellular level. The approach used in this study is to identify and conduct ground-based experiments with cells using tissue culture techniques. Emphasis is being placed on monocots, thus far primarily wheat, rye, and their hybrid triticale. Both haploid and diploid callus cells are being utilized in single cell regeneration and differentiation of callus from such single cells. Those steps in this sequence that are found to be precocious will be tried in the space environment with parallel ground-based experiments. Future attempts will use protoplast isolation and fusion among agronomically important crop plants. The chromosome giemsa technique and scanning electron microscopy have been utilized to study the chromosomal composition of callus cells and the fine structure during differentiation.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

6.0002, BIO-GAS PRODUCTION FROM ALLIGATOR WEEDS

A. Latif, Alcorn State University, Graduate School, Dept. of Biology, *Lorman, Mississippi* 39096 (NSG 8036 SUP No. 4)

OBJECTIVE: Develop a process to produce bio-gas and methane from the microbial anaerobic decomposition of alligator weeds and water hyacinths. Comparison of anaerobic filter digester with conventional anaerobic digester. Evaluation of various physical, chemical and biological factors on the rate, amount and percent composition of bio-gas produced from the microbial anaerobic decomposition of alligator weeds and water hyacinths by the use of anaerobic filter digester. Evaluation of fermented sludge as a supplemental feed.

APPROACH: Alligator weeds and water hyacinths will be chopped and placed in fermentation units. Starter seed will be used from the rumen content of a cow's stomach. Experiments will be conducted by using anaerobic filter digester as well as conventional anaerobic digester.

PROGRESS: Information obtained from the experiments indicate that the higher incubation temperature, pollution of alligator weeds and water hyacinths with heavy metals, addition of poultry droppings and cattle manure to the fermentation units, have increased the amount of bio-gas produced as well as the percentage of methane in bio-gas. Data also indicate the anaerobic filter digester is more efficient than a conventional anaerobic digester. Chemical analysis of sludge reveals that it is rich in protein and minerals and could be used as feed. For conclusive results further studies are in progress.

SUPPORTED BY U.S. National Aeronautics & Space Admin., National Space Technology Lab.

6.0003, EFFECTS OF HEAT ACCLIMATION AND EXERCISE ON ACCELERATION TOLERANCE

C.H. Brown, California State University & Colleges, California State University, Hayward Campus, Graduate School, Student Health Services, *25800 Carlos Bee Blvd., Hayward, California* 94542 (NCA 2-290801)

The purpose of this interchange is to test these hypotheses: a) That acceleration tolerance in subjects riding passively (without compensatory muscular contraction) will decrease following exercise training in a cool environment, and decrease further following exercise training in a hot environment. b) That subjects trained with isometric exercise will have better acceleration tolerance than subjects trained with isotonic exercise. Normotensive men and women and hypertensive men will be trained in hot and cool environments with various combinations of isometric and isotonic exercise regimens. Their tolerance times and other physiological responses will be determined on a human centrifuge.

The results of these studies will be submitted for publication in the scientific literature.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, EFFECTS OF CENTRIFUGATION ON GONADAL AND ADRENOCORTICAL STEROIDS IN RATS

R. Kakihana, California State University & Colleges, San Francisco State University, School of Science, Dept. of Biology, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 2281)

The objective of this research is to study the effects of acute and chronic stress due to the changes in the gravitational force on the pituitary-gonadal and pituitary-adrenocortical systems. Specifically, we attempt to determine the following steroids in the plasma and brain of rats following different duration and intensity of centrifugation stress: testosterone, dihydrotestosterone, estradiol and corticosterone. The gonadal hormones and corticosteroid are assayed by radioimmunoassay and protein-binding assay, respectively, following separation by column partition chromatography.

Preliminary results indicate that the centrifugation stress (2 and 6 hours of 4.1 g centrifugation) caused a significant decrease of plasma and brain (soluble fraction) testosterone, while it increased corticosterone over 10-fold. The plasma corticosterone levels after 16 hours of centrifugation was lower than 2 hour stress, indication some degree of adaptation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, STUDIES IN OLR AND SETI

C.S. Seeger, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NSG 2210)

Continuing studies are proposed in the theory of strategies for the search for extraterrestrial intelligence (SETI) by microwave radio means; and studies in the area of origin of life research (OLR) which are clearly related to SETI. Our research will include the study of signal detection theory and associated techniques, algorithmic and architectural, to improve our ability to recognize an ETI signal; the study and development of a theory for optimum SETI observations using existing radio telescope technology; continuing electromagnetic environmental analysis of observational tests at selected radio astronomy sites; analysis of th problems and possibilities associated with large space antenna systems; and studies to determine the properties of stars for generation of a long-needed stellar catalog. Results of this research will be integrated into the overall plans for the proposed joint ARC-JPL SETI program, and will be embodied in scientific publications, at least one book, several manuscripts for technical journals, and various reports. Further, this research is expected to increase the interest in OLR and SETI and stimulate research in a wide range of related scientific disciplines on the part of scientists not now aware of how their fields of study impinge on research on Life in the Universe concepts and problems.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, THE UNIFIED SYSTEM FOR THE BIOLOGICAL EXPLORATION OF MARS

R.W. Ballard, California State University & Colleges, San Jose State University, School of Science, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2213)

Continuing research using the mass spectrometer and computer data analysis equipment of the 'Unified System' has indicated that it is possible to accurately detect and distinguish organic and inorganic carbon compound in coils. This has been performed by controlled heating of the soil samples from room temperature up to 800 degrees centigrade, and measuring the gases which are evolved. By means of such programmed pyrolysis of the carbon components of the soil, one can distinguish organic from inorganic constituents in the soil. The organic carbon content of soils is of interest to scientists since it is indicative of the organic carbon materials which are available to support living systems.

The second major effort under study has been the comparison of the laboratory research equipment with the Viking flight model engineering test units. This is being accomplished by conducting identical experiments in both laboratory and flight equipment, using simulated Mars soils (smectite clays). These experiments involve parametric studies conducted with fertile and sterile smectite clays at various incubation temperatures using labeled formate nutrient. Samples are incubated at various periods of time from three days to three weeks. The absorption of the nutrients into the soil is measured as well as the gases evolved under the various environmental conditions. All gas analysis measurements are made by the mass spectrometer, the core of the 'Unified System'.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, ALTERED GRAVITY AS A RESEARCH TOOL IN THE STUDY OF MAMMALIAN AGING AND LIFE SPAN

R.C. Ballard, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675906)

The primary goal of the proposed investigation is to assess the rate of aging of young adult rats exposed to continuous centrifugation at 2G. The explicit hypothesis that will be tested is that the rate of aging of centrifuged rats will be significantly higher than that of control animals maintained at 1G. This hypothesis is based on the finding of a 15-20% increase of O2 consumption in rats at 2.5G by Oyama and co-workers and on the 'rate of living' hypothesis proposed by Pearl, which maintains that the rate of aging is proportional to the specific metabolic rate of an animal. The 'rate of living' hypothesis has been validated in invertebrates by many workers (including Miquel, on fruit flies, and Sohal, on house flies). It seems to us that chronic centrifugation is a unique tool for testing of the rate of living hypothesis in mammals. The emphasis in the proposed research will be in developing the methodology and analytical techniques for assessing the rate of aging centrifuged rats. Dr. Jaime Miquel and his collaborators will be studying the fine structure of four key organs of metabolism and internal homeostasis, namely heart, liver, kidney and adrenal gland, which are expected to show high levels of oxygen consumption during centrifugation. Dr. Ralph Ballard and his collaborators at the Department of Biology of San Jose State University will be concerned with the study of possible mitochondrial changes in liver, by investigating oxygen consumption of isolated mitochondria in vitro. An additional task of Dr. Ballard and his research assistants will be the development of techniques and performance of measurements in order to assess the rate of physiological aging in centrifuged rats. The results of these investigations will be made available in a final report and in one of various publications to be coauthored by Dr. Ballard and Dr. Miquel.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0008, PERCEPTION AND PERFORMANCE IN FLIGHT SIMULATION

B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NSG 2269)

The objective of this grant was to study perceptual problems relevant to flight simulation. The research was conducted at Ames Research Center and was carried out by collaboration between students and faculty at San Jose State University and Research scientists at the Center. Work has been conducted in three general areas: (a) vestibular effects on flight simulation, (b) flight management and man-cockpit interfacing, and (c) visual perception in flight simulation.

Five experiments have been conducted on the effects of vibratory, rotary acceleration on pilot performance. The effects of vibratory, rotary acceleration on: response time to suprathreshold rotary acceleration, tracking performance, and sensitivity to angular acceleration, have been studied.

Work has been carried out in several areas of flight management. The following specific problems have been studied: cockpit display of traffic information, workload, automatic speech recognition, synthetic speech call-outs during the landing phase of flight, perceptual factors in the microwave landing system, automation, and total simulation of flight training.

Work carried out in the area of visual perception has been concerned with reduced visibility problems with emphasis on the use of head-up displays. The final report for this grant is being prepared.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0009, ASSESSMENT OF MOTION SICKNESS IN RATS - AN INVESTIGATION OF PICA AS THE RELEVANT BEHAVIORAL MANIFESTATION

R. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675801)

Three experiments will be conducted which will contribute to the assessment of the rat as a model for motion sickness research. The first experiment is designed to develop behavioral assessment procedures for pica, anorexia, and conditioned taste aversion as they are related to motion sickness in the rat, with the objective of establishing sensitive operant measures that are systematically related to severity of motion sickness induced by rotation. The second experiment uses these measures to study the time course of habituation to rotation. A third experiment is designed to assess the value of these measures of motion sickness under several different motion-sickness evoking stimuli (Coriolis acceleration, linear acceleration, sensory conflict, for example).

The end-item of the interchange will be a report describing the results of the three experiments and detailing the best technique for measuring motion sickness in the rat.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0010, CENTRAL SYNAPTIC ACTIONS OF ANTIMOTION SICKNESS AGENTS

R. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675808)

A detailed understanding of the effects of antimotion sickness agents on the central nervous system (CNS) is clearly important to aviation and spaceflight. The various drugs which are currently used to combat motion sickness constitute a pharmacologically diverse group with multiple CNS actions. At present, it is not known which of these actions are crucial to preventing motion sickness. The proposed research will serve two purposes. First, the synaptic action of several antimotion sickness drugs will be determined by examining their presynaptic effects on the uptake of several biogenic amines and their postsynaptic effects on histamine and acetylcholine receptors. Second, these effects will then be related to the antiemetic properties of the drugs using an animal behavioral model. The research is important both for determining the causally relevant antiemetic properties of these agents as well as for evaluating possible undesirable side effects of these drugs.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0011, CHANGES IN CORTISOL AND ANTIDIURETIC HORMONE DURING INDUCED MOTION SICKNESS IN SQUIRREL MONKEYS

R.A. Fox, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NSG 2339)

The purpose of this project is to investigate the relationship between hormones and motion sickness in squirrel monkeys. Changes in the circulating blood levels of vasopressin and cortisol will be examined while susceptible and resistant monkeys are subjected to motion sickness-producing stimulation. Vasopressin is known to be related to nausea and motion sickness in humans and this research will investigate the use of vasopressin as a physiological measure of motion sickness in monkeys. Cortisol is a common measure of general stress which will be used to distinguish general stress effects from motion sickness-specific effects hypothesized to be reflected by vasopressin. These investigations will expand the understanding of hormone changes during motion sickness and will contribute to a better understanding of the physiology of motion sickness.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0012, ESTABLISHMENT OF A SAMPLE TREATMENT PROTOCOL FOR VIRUS DETECTION BY LASER FLUORIMETRY

G.A. Funk, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NSG 2398)

Experiments are being conducted in support of a study to determine the applicability of the laser fluorimeter to virus detection and quantitation. In this instrument, an aqueous suspension of fluorescent-stained virus particles is passed through a fine capillary into a flowing sheath of water, creating a distinct core of sample. An argon laser beam is focused on this core and fluorescent-stained particles passing through the laser beam are excited and emit photons which are detected and counted by a photomultiplier and displayed electronically. Environmental water samples contain varying amounts of non-viral particulate matter which may either clog the capillary and disrupt the core/sheath structure, or which may be stained nonspecifically by the fluorescent reagent and create unacceptable high background levels of fluorescence. One aspect of this study is to devise a procedure for treating water to eliminate all particulate matter and background-contributory substances without removing the virus particles. A second facet of the study is to devise a procedure for attaching a fluorescent reagent to a specific indicator virus, and to evaluate the machine esponse to this labelled preparation.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0013, POPULATION DYNAMICS IN SMALL-SCALE MICROBIAL ECOSYSTEMS

R.D. Haight, California State University & Colleges, San Jose State University, School of Natural Sciences & Mathematics, Dept. of Biological Sciences, *Washington Sq., San Jose, California* 95192 (NCA 2-675907)

Controlled ecological life support systems designed to support man in space will include microorganisms associated with the plant, animal, and human components of the system. Microorganisms will influence the functioning of each of the other components as a result of their metabolic activities. It may be necessary, therefore, to control the behavior of microbial populations if stability in the entire ecosystem is to be attained. These studies will investigate the behaviors of members of a microbial population which have been derived from soil and confined to a specialized, limited environment. In addition, smaller ecosystems of organisms of varying diversity, isolated from the original population, will be studied to determine the relationship between the diversity and stability of an ecosystem as a function of environmental variability. Environmental and biological perturbations will be imposed on the populations in order to see if such variations can be used to achieve stability of ecosystems.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0014, QUANTITATION OF READAPTATION OF SELECTED PHYSIOLOGICAL VARIABLES FOLLOWING ENVIRONMENTAL PERTURBATION

D.C. Holley, California State University & Colleges, San Jose State University, Graduate School, *Washington Sq., San Jose, California* 95192 (NCA 2-675903)

An acute alteration in the normal periodicity of light and darkness, namely placing the subjects into constant light, has recently been shown to negatively effect the ability of monkeys to regulate deep body temperature when temporarily exposed to a cold challenge. We propose to further investigate this novel demonstration of an impairment of homeostasis caused by the removal of normal light-dark cues from the environment. Recently developed mathematical techniques will be used to quantitate the time course of deadaptation and readaptation of certain physiological parameters following photoperiod alterations. Pilot studies will be performed on rats surgically implanted with radiotelemetry devices and blood vascular cannulas. Parameters to be monitored include heart rate, body temperature, locomotor activity, eating and feeding frequency and urinary excretion of sodium, potassium, calcium, and tetrahydrocorticosterone. Following photoperiod alteration, the animals' abilities to regulate or respond to homeostatic challenges will be assessed. Once preliminary experiments have been completed, these studies will be extended to a non-human primate model (monkey). Subsequent findings will be summarized in a final written report.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0015, NITROGEN FIXATION AS AN ADJUNCT TO WASTEWATER PURIFICATION SYSTEM USING WATER HYACINTHS

N.B. Brown, Fort Valley State College, Graduate School, Dept. of Biology, *Fort Valley, Georgia* 31030 (NSG 735)

Recently, the use of aquatic vascular plants as 'polishing agents' to remove residual BOD5 and reduce elemental contamination of nitrogen and phosphorus has gained considerable attention and practical application. However, phosphorus, one of the algae-bloom causing agents, cannot be effectively removed by vascular plants if it exists in an excess of approximately one-third of total Kjeldahl nitrogen.

This project will seek to remedy this problem through these objectives: 1) to employ a model lagoon system consisting of three lagoon tiers using plastic wading pools in a greenhouse (e.g. a solar aqua-cell system), 2) as excess phosphorus promotes algae-blooms, we will exploit the nitrogen-fixing ability of nitrogen-fixing blue-greens to increase the available nitrogen in the model treatment system, 3) to utilize water hyacinth to adequately polish (to EPA standards) the effluent in the presence of the fixed nitrogen.

Initially water hyacinths, Eichharnia crassipes (mart.) solms and blue-green algae, Anabaenopsis circularis (Camb. Univ., strain CU102/3) will be used for investigation and the determination of these parameters.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
National Space Technology Lab.

6.0016, ZOOLOGICAL EFFECTS OF VARIATIONS IN ATMOSPHERIC OXYGEN LEVELS

G. Kloek, Kentucky State University, Undergraduate School, Dept. of Biology, *Frankfort, Kentucky* 40601 (NSG 801)

Since 1974 this research has sought to determine certain limits of survivability, normal life functions, and reproductive life cycles on one small animal. The fruit fly, Drosophila melanogaster, has been subjected to multiple, interrelated variations of atmospheric pressure, oxygen partial pressure, and ambient temperature. Clear boundaries of statistically significant population dynamics have been established. A so-called 'optimal' set of circumstances is difficult to declare since it depends on the criterion measured, and some degree of compensation for one adverse environmental condition may be accomplished by reciprocal manipulation of another. One further gain has been derived from following serial generations of fruit flies to assess possible effects beyond those acting directly on the organism.

The investigator has recently broadened his objectives to include potential use of this animal model in controlled ecology life support systems (CELSS).

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
John F. Kennedy Space Center

6.0017, INVESTIGATION OF MEDICAL INFORMATION MANAGEMENT SYSTEM APPLICATION IN A COMPLEX HEALTH CARE FACILITY

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OBJECTIVES: To utilize a cost-effective computer-based medical records system in a diversified health care delivery environment, including both in-patient and out-patient facilities.

APPROACH: The system is developed from a modified version of MIMS (Medical Information Management System) which was initially developed at NASA-Houston to monitor the health status of astronauts. One element of the health care service facilities will be used as a test area to evaluate the systems operation; after the introduction of modifications arising from the test results, the system will be extended to cover additional service areas.

CURRENT OPERATIONS: The original set of programs were written exclusively for CDC computers. Modification of the programs is being undertaken by staff on this and related contracts, to allow a wider use of the basic systems approach. This will be achieved by writing the programs in a form which is largely machine independent, with a significant degree of optimization to the data base actually in use. Medical Records data is currently being transcribed to computer files in preparation for system testing.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

6.0018, REGULATION OF THE ADRENAL CORTEX FUNCTION DURING STRESS

K.F. Soliman, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, Dept. of Pharmacology, *Tallahassee, Florida* 32307 (NSG 2183)

The objective of this proposal is to study peripheral control of the adrenal cortex during stress. Rats will be used as experimental models for this project. Stresses being studied include ether, histamine or endotoxin administration, or cold exposure. In this study the adrenal medullary enzymes (tyrosine hydroxylase, dopamine hydroxylase and PNMT) will be examined in relation to stress. The liver glucocorticoids sulfotransferase and brain tryptophan hydroxylase activities will be related to the availability of the adrenal medullary hormones and to the exposure to stress. The effect of circadian rhythm on these biochemical mediators will be investigated. The brain biogenic amines or different parts of the brain will be studied in relation to stress and circadian rhythm. In another study the synthesis and the release of glucocorticoids will be investigated using isolated adrenal cells. The adrenal cellular response to histamine, endotoxin and ACTH will be evaluated in relation to the availability of epinephrine in the media. Finally, glucocorticoids half life and tissue binding and the glucocorticoids receptors will be evaluated in relation to epinephrine administration or stress exposure.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0019, LIVER CELLS - A MODEL SYSTEM FOR STUDIES ON METABOLISM IN SPACE

M.E. Tolbert, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2311)

Presently, and with due justification, there is strong concentration on the function of the liver relative to space travel. Studies on liver metabolism are of great interest in view of the fact that liver function impairment has been implicated in reduced caloric utilization and in weight reduction among mammals in space. The effects of space flight on the mammalian system cannot be correctly evaluated until the factors affecting the underlying biological mechanisms are thoroughly understood.

In view of the need to investigate liver functions and their regulation more thoroughly, the present program of research was developed with objectives as follows: 1) to perfect a technique for the isolation of a large population of intact liver parenchymal cells which will be useful in space laboratories where studies of liver functions are conducted, 2) to isolate a uniform system of intact liver cells to serve as a suitable test system for studies on liver functions in zero gravity, and 3) to document the characteristics of the isolated liver cell system so that it can become a useful base of reference for studies of liver functions under space conditions.

The results of these and other studies may provide man with the information needed to sustain human life on other planets and may also increase man's adaptive capability for prolonged space flights. In general, the isolated hepatic cell system will be projected as a model system for studies involving mechanism of drug action and general liver processes. The system being developed will be projected as one for use in hepatic research laboratories in space.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0020, THE INFLUENCE OF ENDOGENOUS AMINES ON DIURNAL TOXICITY OF CNS STIMULANTS AND DEPRESSANTS

C.A. Walker, State University System of Florida, Florida Agricultural & Mechanical University, School of Pharmacy, *Tallahassee, Florida* 32307 (NSG 2029)

The progress report to date shows that circadian rhythms have been established for all the major neurotransmitters. During the past year our lab established for the first time circadian rhythms in specific brain parts for glycine. High concentrations were noted in the pons. The possibility of glycine receptors in the brain indicate a need for additional studies involving the pons and drugs that affect glycine.

We propose to continue the identification and investigation of drugs (central nervous system stimulants and depressants) in terms of significant circadian variations in toxicity (LD50) and therapeutic effectiveness (ED50). The effects of these drugs on brain amines at different times of the day will be extensively examined including the chronopharmacokinetic. The compounds to be measured will include GABA and cyclic AMP. Attempts will be made to complete a circadian profile simultaneously for epinephrine, norepinephrine, acetylcholine, serotonin, histamine, GABA, glycine and cyclic AMP for cortex, midbrain, caudate nucleus, cerebellum and specific areas of the spinal cord. Alterations in environmental parameters to include reverse cycles, uneven length of light-dark cycles and time periods for light-dark adaptations will be continued in this investigation. Small laboratory animals will be used (mice and rats) initially, followed by larger animals when studying the therapeutic effectiveness of specific drugs. The animals will be adapted in the regular manner in a temperature controlled environmental room equipped for automatic programmed illumination cycles.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0021, MORPHOMETRICS OF CELLULAR DAMAGE IN MICE RECEIVING WHOLE BODY IRRADIATION

W.J. Sapp, Tuskegee Inst., School of Arts & Sciences, Dept. of Biology, *Tuskegee Institute, Alabama* 36088 (NCC 2-12)

This research is designed to investigate the effects of radiation from high energy particles (HZE) on the proliferating germinal epithelium in mice testes. Morphometrics of cellular damage due to radiation can be easily assessed in the seminiferous epithelium of the testis since the spermatogonial cells proliferate rapidly, and in certain stages, are extremely radiosensitive.

Dose is one important variable in radiation studies, and quantitation of dose effects is a necessary step in evaluation of radiation damage. Since various spermatogonial cells can be identified morphologically, the testis provides excellent material for quantitative studies.

This work involves exposure of brown mice to whole-body or testicular irradiation with beams of heavy ion particles such as neon and argon.

After irradiation, the testicular tissue will be processed in the usual manner for electron microscopy. The plastic-embedded tissue can be sectioned for either light or electron microscopy.

In addition to determining the relative biological effectiveness (RBE) of various heavy ion particles, this work will also involve a determination of the nuclear and cytoplasmic volumes in certain tissues, an ultrastructural study of the radiation effects on specific cells, and autoradiography as a means of determining the sensitivity of specific cells and the cell renewal processes.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0022, AQUATIC VASCULAR PLANTS AND ALGAE AS POTENTIAL BIOLOGICAL COMPONENTS OF CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS

G.C. Gupta, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6034)

BACKGROUND: A recent study by NASA Ames Research Center has emphasized the use of biological methods for wastewater treatment (recycling) and food production in Closed Ecological Life Support Systems (CELSS) for Large Space Habitats. Use of aquatic vascular plants and/or algae under terrestrial environment has been very promising in the two areas of waste recycling and food production. Information is not available on the use of aquatic vascular plants and algae under controlled/closed environments.

OBJECTIVE: Objective of this work is to complete a literature review and discuss with experts the potential problem areas in the use of aquatic vascular plants and algae under Controlled/Closed environments.

PROGRESS: Water Hyacinths and duckweed have been selected as the plants for possible use in CELSS for wastewater recycling and food (protein) production. Very little work on CELSS has been done in United States. Russian scientists have utilized algae for CELSS but details of their experimental designs are not available. Current plans are to design an experiment to study the gas exchange (CO2-O2) and evapotranspiration on the use of water hyacinths/algae in closed or partially closed ecological life support systems. This work is an integral part of NASA's ongoing research on Potential Biological Components of CELSS for Large Space Habitats.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Wallops Flight Center

6.0023, STUDIES OF MICROWAVE RADIATION AS A TOOL IN SOIL STERILIZATION AGAINST MAJOR DISEASES AND PESTS OF AGRICULTURAL CROPS

J.G. Wutoh, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Biology, *Princess Anne, Maryland* 21853 (NSG 6006)

Soil samples from different soil types and locations were analyzed for soil microorganisms and arthropods before and after exposure to 2450MHz, 6KW fully conveyorized microwave source. The effect of the microwave radiation on the soil organisms was assessed using the classical microbiological method, and the Dry-Funnel method for extraction of small arthropods developed by K.E. Fletcher of the Rothamsted Experiment Station at Harpenden, England. Results so far indicate that all fungi were readily killed by the microwave treatment; all nitrogen-fixing bacteria were inactivated and killed but some spore forming bacteria survived; no nematodes survived the microwave treatment and all isolated arthropods (eggs, larvae and adults) were found killed by the microwave treatment. The effect of the microwave on the soil organisms was non-selective and there did not appear to be any residual effects of the microwave; lower pH values of the microwaved soils and increase in the acidity were detected. The soils showed no changes in their compositions but there was a significant decrease in most of the chemical components of the treated soils; growth of plants (peanut) in the early stages was retarded in treated soils but improved and were better than controls; flowering occurred (early) in the microwave treated soils and not in the untreated controls.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Wallops Flight Center

6.0024, DETERMINATION OF SELECTED TOXIC METALS IN SEDIMENTS AND BENTHIC SPECIES IN RELATION TO NUCLEAR POWER PLANT OPERATIONS

H.L. Phelps, University of the District of Columbia, School of Natural Applied & Health Sciences, Dept. of Biology, *1331 H St. N.W., Washington, District of Columbia* 20005 (NGR 09-050-019)

Trends in copper and zinc concentrations in oysters from the central Chesapeake Bay region are being studied. Oysters were collected in June 1978 and June 1979 from 13 sites in clean and polluted areas, near two power plants, and a seed area. A minimum of 29 oysters from each site were individually analyzed for copper and zinc using nitric acid wet digestion, filtration and flame atomic absorption. Preliminary results indicate: 1) Zinc and copper concentrations were always significantly positively correlated and the copper/zinc ratios were highest in oysters from the two power plant and oyster seed areas. 2) Copper concentrations in oysters were significantly negatively correlated with site salinity in 1978 (-6.2ppm/ppt) and 1979 (-6.7 ppm/ppt). 3) Copper concentrations were significantly negatively correlated with individual oyster wet weights at half the sites. 4) Zinc concentrations in oysters were generally not significantly correlated with either site salinity or individual oyster weights. 5) Oysters from the seed are consistently had the highest copper concentrations and copper/zinc ratio. 6) Copper concentrations increased in oysters from the central bay region and decreased in oysters from the Patuxent and Potomac rivers. 7) Oysters from the Calvert Cliffs Nuclear Power Plant area continued to show increasing concentrations of copper relative to reference areas; however oysters from the Chalk Point Power Plant area which has recently installed cooling towers had significantly decreased copper concentrations. Sampling and analyses are continuing.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

6.0025, GLUCONEOGENESIS AND GLYCOGENOLYSIS - THE 24-HR PATTERN AND CORRELATION OF SEVERAL PHYSIOLOGIC FUNCTIONS

P.U. Ashman, Xavier University of Louisiana, School of Arts & Sciences, Dept. of Biology, *7325 Palmetto St., New Orleans, Louisiana* 70125 (NGR 19-007-004)

The purpose of this study is to correlate the 24-hour patterns of several biochemical tissue constituents such as liver glycogen, blood glucose, certain enzymes and the controlling factors involved in rat hepatic gluconeogenesis and glycogenolysis. Rats are maintained in 12 hours of altering light and dark in an isolated room. At the end of the experimental regimen, organ and tissues are harvested at 4-hour intervals throughout a 24-hour period. The tissue constituents are then assayed for possible diurnal variations. Significant diurnal variations have been found for rat hepatic glucose-6-phosphatase (EC. 3.1.3.9), neutral fructose 1,6-diphosphatase (EC. 3.1.3.11, Ashman et al., 1976. Comp. Biochem. Physiol. 53B: 315-318), phosphohexose isomerase (EC. 5.3.1.9), phosphoglucomutase (EC. 2.7.5.1), glutamate-oxaloacetate transaminase (EC 2.6.1.1), liver glycogen, plasma glucose, plasma corticosterone and stomach plus contents weights. Correlations were made between circadian locomotor activities, plasma corticosterone, liver glycogen and the enzymes. Corticosterone levels peak immediately at the onset of the dark period when the rats begin their running. When rats eat during the dark period, liver glycogen is stored until it reaches maximum levels during the light period. As the investigation progresses, additional correlations will be made in the hope of establishing a marker rhythm for the other tissue constituents.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

6.0026, SATURATED HEATED OXYGEN/BLEED AIR NEBULIZER FOR RESUSCITATION OF THERMAL CASUALTIES IN AIR EVACUATION

F.S. Pettyjohn, U.S. Dept. of Defense, Army, Medical Research & Development Command, Aviation Medicine Research Div., *Fort Rucker, Ozark, Alabama* 36360 (DA0B6902)

To develop and test the concept of use of heated saturated oxygen/bleed air in helicopter air evacuation/resuscitation of the hypothermic or pulmonary casualty.

Develop new technology and equipment to use helicopter bleed-air and electrical power 28 VDC or 115 VAC 400 Hz to provide a source of heated, dry or super-saturated oxygen or air to deliver heat to the hypothermic combat casualty. The concept of the lungs as a heat exchanger employing the extremely large surface area available for the passage of blood as a distributor of heat to distal organs represents a unique application in air evacuation and resuscitation. The equipment will be designed for simplicity, low cost, and compatibility with UH-IH aeromedical helicopters. Compatibility with advanced oxygen systems (chlorate candle and Army molecular sieve oxygen generators) will be explored. Concept and prototype evaluation will be conducted using mongrel dogs as subjects. Monitoring of temperature and pulmonary effects of increased inspiratory air/oxygen during simulated and in-flight evacuation missions will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Medical Research &
Development Command, Aeromedical
Research Lab.

6.0027, TERRAIN VISUAL CUE REQUIREMENTS FOR FLIGHT SIMULATION

G.H. Buckland, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF223200)

1. To investigate the relative utility of different types of terrain visual cues for low altitude visual flight simulation, 2. To evaluate the relative importance of the trade-offs between the limited number of possible visual cues, and 3. To develop the optimum visual scene for ASPT, for use in other research and training which requires low altitude visual flight simulation.

Dual phase experiments will be used. Experienced pilots will participate in either the landing or NOE studies. The general approach will be to vary the types of visual cues available to the pilots and study the effects of these cues upon their subsequent performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0028, STUDY CONTROL CONCEPTS FOR LOW-COST TRAINING

B. McFadden, McFadden Electronics, *8953 Atlantic Blvd., South Gate, California* 90280 (DN894039; N61339-78-C-0170)

Low-cost electronics are making possible very low-cost, part-task aviation skills trainers. To be effective, low-cost controls with acceptable feel will be required. This study will identify approaches and fabricate examples for evaluation.

Models of control feel will be studied to determine necessary characteristics. Implementation schemes will then be considered and samples fabricated.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0029, CGI TECHNIQUES EVALUATION

D. Cohen, University of Southern California, Information Sciences Inst., *Marina Del Rey, California* 90291 (DN794044; N61339-77-C-0154)

The objective of this task is to conduct a state of the art survey on the application of computer generated imagery (CGI) to flight simulation devices, a technological forecast of advances, and assess the future of this technology and its impact on Navy flight training in the early 80's.

The survey will address the following issues: (a) state of the art, (b) human factor aspects, (c) expected future progress, and (d) probable impact of new technology.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Experimental Computer Simulation Lab.

6.0030, INTERSTIMULUS INTERVAL AS IT AFFECTS TEMPORARY THRESHOLD SHIFT IN SERIAL PRESENTATIONS OF LOUD TONES

J.V. Tobias, U.S. Dept. of Transportation, Federal Aviation Admin., Office of Aviation Medicine, *800 Independence Ave. S.W., Washington, District of Columbia* 20591 (FAA-AM-79-16)

Temporary threshold shifts were measured repeatedly during a session in order to determine effects of interstimulus interval (ISI) on the shift. The fatiguing sound was a 3-minute, 110-dB-SPL, 4,000-Hz tone. Immediately following the 3-minute stimulation, Bekesy-audiometric tracings were made for 3 minutes at 5,656 Hz. Then the subject sat quietly for the ISI that was used during that session. The effect of the subject's rest time or time off was compared at two points on the recovery curve: at 30 seconds and at 2 minutes following the cessation of the fatiguing sound. For susceptible subjects tested with short-duration ISIs, each successive threshold showed a greater shift than the earlier ones for at least four tests. As ISI was increased, improvement seemed not to follow the expected linear form. At some critical value that varies from subject to subject, successive tests no longer differ from each other; each one is similar to a first trial in which no previous exposure to the high-level tone has occurred. For most subjects run under these conditions, the critical ISI value is at least 30 minutes.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin., Office of Aviation Medicine

6.0031, IMPROVING FLEET EFFECTIVENESS THROUGH IMPROVED NAVY AND MARINE CORPS AIRCREW PERFORMANCE ASSESSMENT

R.E. Doll, U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab., *Pensacola, Florida* 32512 (DN141808)

Development and implementation of systems for forecasting likelihood of training completion has reduced costly attrition and resulted in improved fleet effectiveness. Among aviators and naval flight officers who complete training, however, substantial costs are still incurred through attrition in replacement training squadrons (RTSs) and a continuing incidence of marginal and unsatisfactory fleet performance, reflecting both individual differences in capability and problems in training and RTS syllabi. Identifying relevant differences in skill and ability and optimizing syllabus responsiveness to operational demands requires valid and reliable performance measurement. the objective of this work unit is to develop improved methods for assessment of aircrew performance and to utilize performance data in recommendations for improved fleet effectiveness.

Standardized performance assessment methods will be developed and evaluated, and elements critical to fleet performance determined. selection and assignment procedures will be developed and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Naval Aerospace Medical Research Lab., Aerospace Psychology Dept.

6.0032, PERSONNEL TECHNOLOGY - HUMAN PLANNING AND PROBLEM SOLVING IN ROUTE CONSTRUCTION

A. Stevens, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DN875263; N00014-78-C-0235)

Navy and Marine Corps jobs such as navigation, air traffic control, and fire control require personnel to formulate a plan or sequence of instructions from information which must be extracted from a visual display. This work will construct a theory and particular models of this process in selected route-planning scenarios. The theory will identify and evaluate heuristics used in route planning and determine how these heuristics relate to the observable behavior of individuals engaged in route planning and traversal. A particular goal of the theory is an account of how analytic and symbolic planning processes relate to the spatial and graphic representations of the area being traversed.

Spatial representations will be formalized in the theory through the use of a constraint network which can be used to derive quantitative constraints from symbolic statements about the space. Planning heuristics will be formalized as constraints which can be entered in the network. Taken as a whole the theory will be applied to protocols taken from a simulation system which allows for laboratory observation of route planning and route traversal behavior. Additional experiments on route memory will be used to test the spatial representation used in the theory.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0033, PERSONNEL TECHNOLOGY - COGNITIVE-FACTORS ANALYSIS OF SKILLED HUMAN PERFORMANCE

S.W. Keele, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Psychology, *1472 Kincaid St., Eugene, Oregon* 97401 (DN775694; N00014-77-C-0643)

This work will explore a cognitive-factors approach to analysis and prediction of skilled performance under high information loads characteristic of those found in piloting, fire control, and other military jobs. The work seeks to establish the construct validity of a number of cognitive abilities, including attentional flexibility, time-sharing, concentration, spatial orientation, and executive functions. Measures of these factors will be derived and empirically evaluated in terms of both concurrent and predictive validity.

Further validation studies will be carried out for previously refined measures of attentional flexibility. The construct validity of the concentration factor will be studies using tasks measuring the ability to disregard target information presented on to-be-ignored channels. Previously discovered factors of time-sharing ability will be construct-validated, and measures calibrated on experienced pilots. At least one new task will be formulated to assess executive function. A four-task assessment battery for spatial abilities will be tried on flight-training students.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, STATISTICAL CLASSIFICATION TECHNIQUES FOR ENGINEERING AND CLIMATIC DATA SAMPLES

E.C. Temple, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Mathematics, *Normal, Alabama* 35762 (NSG 8065)

When standard classification roles (or models) are constructed from sample data, it is known that the probability of misclassification is not minimized. Thus, the primary objective of the proposed research was to develop a biased Probability of Misclassification (PMC) model for classifying observations from a multivariate normal population such that the PMC is minimized. The purpose of the PMC model is to develop a tool for the statistical classification of practical engineering problems of interest to NASA for the Space Shuttle Program and the NASA Climatic Program.

A biased sample discriminant model using only principal component procedures has been investigated. Computer simulation experiments have been used to assess the effect of the biased procedures on the probability of misclassification. The performance of the biased model has not indicated acceptable results. Thus, an expanded research focus will be initiated under Grant #NSG-8065 Supplement 1. The focus will be a consideration of more general biasing approach to the problem.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0002, HOLOGRAPHIC GRATINGS FOR SPECTROGRAPHIC APPLICATIONS - STUDY OF ABERRATIONS

M.S. Bhatia, Bowie State College, Graduate School, Dept. of Mathematics, *Bowie, Maryland* 20715 (NGR 21-027-010)

The study of the optimum performance and ruling conditions relative to holographic grating technology is continued. As reported in the documents # X-720-77-79, X-720-77-145, X-722-78-3 and X-722-78-31 we have developed computer programs to determine design parameters to rule holographic aberration corrected diffraction gratings and Rowland Circle spectrographic mounts. We will investigate the design of aberration corrected holographic toroid gratings for Seya Namioka and for Rowland Circle spectrographic mounts. It is also expected that the analysis of the theory of Type III holographic gratings with regard to correction of aberrations will be initiated.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0003, RESEARCH IN NUMERICAL INTEGRATION AND ATTITUDE CONTROL LAWS

S. Srivastava, Bowie State College, Graduate School, Dept. of Mathematics & Science, *Bowie, Maryland* 20715 (NGR 21-027-004)

This project investigates the process of updating attitude quaternion without depressing the size of state co-variance matrix, which amounts to a search for a proper filter preserving the positive definiteness.

The kinematic equations can be written in differential form using the quaternion representation of the attitude. This is generally preferred to the Euler angle representation because of its analytical characteristics.

The attitude quaternion, along with the current noise contribution, is propagated to present time. Matrices Q (6x6) and phi (6x6) are formed. P (6x6) is propagated to update time using phi and Q. The Kalman gain matrix K is computed, then finally the attitude quaternion is updated.

This process of updating involves so much of extra computation that it is desirable to (i) propagate without depressing the size of Q; (ii) then to calculate the gain K; (iii) update the attitude quaternion.

In doing so, some inequalities creep in, possibly because of loss of positive definiteness. Square root filter, UDUT, or some modified versions are most likely to work. This is being investigated now.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0004, JOINT DEVELOPMENT OF A DISPLAY SOFTWARE SYSTEM FOR UNSTEADY TRANSONIC FLOW FIELD COMPUTATIONS

J. Mitchem, California State University & Colleges, San Jose State University, School of Science, Dept. of Mathematics, *Washington Sq., San Jose, California* 95192 (NCA 2-675901)

Extensive computer codes are now being developed at NASA-Ames Research Center to study the unsteady transonic aerodynamics of oscillating airfoils and helicopter rotors. A finite difference procedure is used to solve the governing equations of the flow field. The solutions result in a great amount of data representing the unsteady characteristics of the flow field and thus require an efficient display-software system for organizing the data. It is this system that is proposed for development. The task will involve the development of computer programs, the output of which, in the form of graphics displays or movies should show the following features: 1) The time history of the automatic grid-generation to show it being tailored for the computation of oscillating airfoils or helicopter rotors. 2) The variation of the aerodynamic characteristics represented by the pressure distribution along the airfoils, constant Mach number and density contours, velocity vectors, and stream lines. 3) The phase shifts between the aerodynamic forces and the airfoil motions.

The documentation of the system should be user-oriented conceptually, including sample operations.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

7.0005, ALGORITHMS FOR EFFECTIVE USE OF THE CDC STAR-100 COMPUTER IN THE SOLUTION OF OVER-DETERMINED LINEAR SYSTEMS OF LINEAR EQUATIONS

S.N. Shah, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NCC 1-7)

The objective of the proposed research is to develop a vectorized algorithm to solve over-determined systems of linear equations with real coefficients to make effective use of the CDC-STAR-100 computer, which has capabilities for processing vector quantities and performing vector operations.

APPROACH/PROGRESS/PLANS: The coefficient matrix is stored as vectors, column wise, and the computations are reorganized to take advantage of STAR-100 architecture and capabilities. Initial results show that in the case of 120 linear equations with 100 unknowns, the new algorithm solves the system in less than 12% of the time taken by the non-vectorized algorithm solving the same system. Future plans are to store the coefficient matrix row-wise and perform more numerical experiments by reorganizing computations.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

7.0006, TEST FOR DIURNAL RAINFALL VARIATION

T.L. Gill, Howard University, Graduate School of Arts & Sciences, Dept. of Mathematics, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NSG 5295)

In this Research project, we use a distribution free method known as the Kolmogrov-Smirnov Statistic in conjunction with the Wilcox test in order to analyze rainfall data obtained from the G.A.T.E. Program over the Atlantic Ocean. The objective is to provide answers to a number of important questions associated with rainfall variation over the oceans. In particular we plan to determine those oceanic regions where there is a diurnal rainfall variation and evaluate the level statistical confidence for each region. We also plan to evaluate the sensitivity of our conclusions as a function of the number of rainfall data points and identify any periodic behavior in the daily rainfall rate.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0007, MEDICAL INFORMATION MANAGEMENT SYSTEM

J.W. Frankowsky, Lincoln University, Undergraduate School, Dept. of Mathematics, *Lincoln University, Pennsylvania* 19352 (NAS 5-23800)

The Medical Information Management System ("MIMS") is a NASA-developed computerized system that will allow a hospital, laboratory, clinic or private physician to create and control a medical data base on patients. The system is interactive, has flexible format and provides the user with the ability to create records, recall records, search for specific data and do research with the data base created.

Current modifications continue program conversions that permit the system to operate on mini computers. Extensions of MIMS are being made so as to enhance its use in an ORC mode in conjunction with the requirements for research particularly as applicable to non-invasive vascular research. In addition, effort is being made to combine the MIMS System with INTERNIST (Univ. of Pittsburgh) and MEDAS (Univ. of Southern California) so as to form a physician-user oriented computer aided medical diagnostic tool.

There is close cooperation with selected physicians and medical facilities in order to design and test the programs for useful data formats, decide what data to store and test all parameters of the system.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0008, NUMERICAL DIFFERENTIATION AND INTERPOLATION PROCEDURES WITH ERROR ESTIMATES FOR NON-EXACT DATA

R.E. Bozeman, Morehouse College, School of Arts & Sciences, Dept. of Mathematics, *223 Chestnut St. S.W., Atlanta, Georgia* 30314

Most techniques that are available for differentiating finite data sets make the assumption that the data is precise or exact. Consequently, these procedures do not take into account errors that may be due to observation when data is collected from experiments. There are, however, several techniques that appear to be suitable for differentiating experimental data and in this study an analysis will be made of these procedures. The ultimate goal is to either identify an existing procedure or devise a new one that minimizes the error of estimation of the derivative including truncation errors as well as errors of observation in the original data set. Specifically an integral equation and regularization procedure and a time series technique will be considered.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

7.0009, ASSESSMENT OF THE QUALITY OF 'GATE' AREA RAINFALL DATA FROM A NIMBUS-5 RADIOMETER

N. Knox, Morgan State University, School of Arts & Sciences, Dept. of Mathematics, *Baltimore, Maryland* 21212

The purpose of this study is to evaluate the quality of rain intensity estimates derived from passive microwave measurements by the Nimbus-5 Electrically Scanned Microwave Radiometer during the GARP (Global Atmospheric Research Program) Atlantic Tropical Experiment (GATE). To do this, the following tasks must be completed: 1. Collect and verify computer printouts of ESMR-5 GATE coincident data. 2. Use the ESMR-5 calibration curves to convert ESMR-5 brightness temperatures to rain intensity estimates for a two degree square centered at (23.5 degrees W, 8.5 degrees N). 3. Compare ESMR-5 rain intensity estimates to coincident GATE radar measurements of rain rate.

At this time seventy-one ESMR-5 measurements coincident with GATE radar measurements have been retrieved from computer compatible tapes at Goddard Space Flight Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0010, MEDICAL APPLICATION FOR COMPUTER TECHNOLOGY

F.A. Fresh, State University System of Florida, Florida Agricultural & Mechanical University, School of Business & Industry, Management Sciences Division, *Tallahassee, Florida* 32307 (NAS 5-25165)

There exists several parallel attempts to develop a tractable and efficient automated system to assist physicians to make differential diagnoses. The availability of such an operational system would enable the extension of medical care to relatively remote areas (i.e., rural or space) through a greater reliance on the paramedical personnel. Differences among some of the systems currently under investigation include the theoretical basis for the underlying model (i.e., Bayesian and artificial intelligence) and the availability of an adequate medical knowledge base. The objective of this project is to identify a computer-based model which offers the capabilities for differential diagnosis, extensive medical knowledge base, maintainable in a common computer language and transportable to multiple, economical hardware environments. This project is investigating means to integrate the available technology into a system which can be made operational.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0011, A CHRONOLOGY AND RETRIEVAL SYSTEM FOR WALLOPS FLIGHT CENTER ATMOSPHERIC DATA

J.C. Smith, University of Maryland, Eastern Shore, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 6016)

The University of Maryland, Eastern Shore (MES) is conducting efforts as a part of Research Grant, Office of University Affairs Grant No. NSG 6016, to respond to a need by the NASA, Wallops Flight Center (WFC) to determine and chronologically compile the atmospheric measurement data taken in past years in that geographical area (i.e., within atmosphere sensors). The overall objective is to develop an information-base filing and retrieval system that will provide scientists with ready access to Wallops Flight Center atmospheric data. More specifically, a computerized recovery of information by type of measurements (parameters), instruments, altitude, time of day and other pertinent facts, is visualized as an ultimate goal. Grant efforts have followed the NASA recommendation of a phased approach.

PHASE I: The first phase centered upon enlisting the aid of Wallops Flight Center people and learning of the resources available. Initial interviews and initial results yielded a Verified Basic Listing for Tabulation.

PHASE II: Phase II efforts approached the initial task to create a summary catalog of the primary data base consisting of more than eighty-six hundred (8600) project or experiment cases. Utilization of Phase I results and new development of methods, personnel training, and follow-on needs to handle the varied types of data and sources categorically related to meteorology, aeronomy, and the interdisciplinary atmospheric-geophysical sciences has produced a Preliminary Summary Data Catalog in three (3) volumes.

Case selection, initial entries of NASA experiments are on catalog data sheets A and B for 1977, and 1978 are complete. (Research efforts to identify, locate and list experiment-related science and technical publications for Volume 4 have been initiated utilizing the RECON system at NASA Wallops Flight Center.)

Efforts have also been initiated with NASA WFC Personnel to provide magnetic data tapes that contain most of the meteorological rocket and Jimsphere information suitable for inclusion during software development.

A computerized output and listing of our current total of experiment-related publications has been prepared, and a library collection of assembled WFC experiment or case related publications will soon be displayed in the NASA Technical Library.(Text Abridged)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Wallops Flight Center

7.0012, RESEARCH IN ORBIT DETERMINATION

J.S. Bakshi, University of the District of Columbia, School of Engineering Technologies, Dept. of Mathematics, *4100 Con-*

necticut Ave. N.W., Washington, District of Columbia 20008 (NSG 5122)

The attitude of the spacecraft when expressed in Euler's form can be described by a differential equation using quaternion. An exact solution for this equation can be found by using average angular body rate. In this project, the task is to compare accuracy and ease of computation for the propagation of quaternion, when the average angular rate is not used. Furthermore, an attempt is being made to find a suitable method or a suitable filter to propagate attitude quaternion without depressing the size of state convariance matrix which will preserve positive definiteness and stability. The use of Kalman filter, in this project is compared with Schmidt, Potter and other filters.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

7.0013, METHODS FOR MAKING A NUMBER OF STRUCTURALLY SIMILAR STATISTICAL DECISIONS WITH APPLICATIONS TO THE ANALYSIS OF REMOTE SENSING DATA

S. Vardeman, Purdue University, School of Science, Dept. of Mathematics, *Executive Bldg., West Lafayette, Indiana* 47907 (MCS78-04366 A01)

Professor Vardeman will consider decision theoretic questions arising in situations in which a number of structurally similar but statistically independent decisions are to be made simultaneously or serially. He will study the decision theoretic basis for making large numbers of classification decisions and will apply this theory to the analysis of remote sensing data.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Mathematical &
Computer Sciences

7.0014, BACKSCATTER RAY TRACE

T.B. Barrett, Parke Mathematical Lab. Inc., *1 River Rd., Carlisle, Massachusetts* 01741 (DF902400; F19628-77-C-0054)

AF function - high frequency radar detection at long range. Deficiency - inadequate mathematical and computer techniques are available to translate ionospheric measurements into short-term predictions on the effects imposed by ionosphere on oth radar. Objective - develop computer automation for ray-tracing synthesis of backscatter-radar ionograms, and for inference of ionospheric electron distributions from observed backscatter ionograms. How research contributes -backscatter ionograms can potentially be computer processed to produce electron distributions in the region of radar surveillance, and thus can be used to update current ionospheric models. Backscatter radar observations on group-path range and apparent azimuth can be converted to ground range and true azimuth when the electron distribution is known.

The approach to this effort will be to develop computer techniques to automate the synthesis of swept-frequency backscatter ionograms, using three-dimensional ray-tracing computations for given electron distributions. Techniques will be developed for categorization, storage and retrieval of major characteristics of the synthesized ionograms. A computerized procedure will be developed for converting an observed ionogram into electron distribution by computing ionograms for trial electron distributions till the computer matches the observed ionogram.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome
Air Development Center

7.0015, SOLUTION OF REYNOLD'S EQUATIONS

W.E. Simpkin, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DN890155; N00019-79-C-0136)

Jet entrainment is dependent on the jet velocity profile and turbulence level which at present are not accounted for in model testing or in mathematical models of jet entrainment and mixing. The ultimate goal of this work is to develop a model that will account for all the major parameters in the mixing process, such that jet entrainment can be modelled.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air
Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, SOLUTION GROWTH OF CRYSTALS IN ZERO-GRAVITY

R.B. Lal, Alabama Agricultural & Mechanical University, School of Arts & Sciences, Dept. of Physics & Mathematics, *Normal, Alabama* 35762 (NAS8-32945)

A series of experiments will be performed in which crystals will be grown by the low-temperature solution growth technique in a microgravity environment of the orbital Spacelab. The objectives are: (1) to produce structurally more homogeneous crystals free from inclusions of solution by eliminating convection transients, (2) to obtain data on mass and heat transport in diffusion controlled growth system, and (3) to confirm the advantages of a microgravity environment for solution crystal growth. Triglycine sulfate (TGS) crystals will be grown in the Fluid Experiment System (FES) on Spacelab III by slowly extracting heat at a programmed rate through a seed crystal of TGS suspended on an insulated string in a saturated solution of TGS. Variations in the liquid density, solution concentration, and temperature around the growing crystal will be studied using a holographic technique. Growth in earth gravity will be studied by the same techniques and the resulting crystalline features will be compared and correlated with the growth conditions. In a microgravity environment it should be possible to eliminate convective flows and establish a diffusion controlled transport of the solute to the interface. By extracting heat from the crystal in a controlled manner, it should allow a slow but uniform growth resulting in a high degree of crystal perfection. Also, TGS has practical applications as infrared detectors whose performance might be improved by increased perfection. Experiments for the growth of TGS crystals are in progress. For the first time, crystals of TGS have been grown by cooling the seed crystal.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

8.0002, A STUDY OF OPTIMUM INSULATION CONFIGURATIONS AND MATERIALS

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The objective of this project is to find ways to passively protect equipment or structures from fires or other heating environments (e.g. by insulating the equipment from the fire), or to prevent propagation of compartmental fires to adjoining compartments. Systematic designs of fire protection systems are being done with mathematical models of fire protection and insulation systems.

The goals are: high level protection per unit weight, high durability, negligible toxic gas and smoke production, and resistance to corrosion from salt and humid atmospheres. The proposed configuration consists of numerous 'thin' insulative layers, with an air gap separating each layer. NASA has developed a mathematical model of this system containing air gaps, and a number of optimum designs have been analytically determined. NASA is also conducting an experimental fire testing program to verify the performance of these systems. This agreement will compare the mathematical and experimental findings for these types of protection systems in an effort to implement practical fire-protection systems.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

8.0003, THEORY OF STRONG TURBULENCE BY RENORMALIZATION INTO REPEATED-CASCADE

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The general problem of turbulence and the particular problem of optical turbulence concern a system of stochastic and nonlinear partial differential equations in configuration space. The difficulty as introduced by velocity can be minimized by a kinetic approach, transforming the said system to a master equation in phase space. The velocity now being an independent variable ceases to cause nonlinearity. The closure thus simplified is performed by a scaling procedure, involving macro-evolution, micro-transport coefficient, and submicro-relaxation. This kinetic approach reproduces the Kolmogoroff spectrum for incompressible turbulence, and derives other spectra for compressible turbulence and plasma turbulence. It is planned to extend to optical turbulence: scintillation at long path, saturation, and optical remote sensing, without the restriction from familiar hypotheses of frozen turbulence, small scales, and Markoff process.

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SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

8.0004, MEASUREMENT OF THE VAPOR PHASE COMPOSITION AND PRESSURE FOR LIQUID-VAPOR EQUILIBRIUM IN AQUEOUS SOLUTIONS OF SULFURIC ACID

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The thermodynamic parameters needed for modeling the atmospheric aerosol formation are not available. This is particularly true of the sulfuric acid-water system which is important and of contemporary interest.

To meet this, a series of experiments have been initiated which will provide the equilibrium partial pressures of vapor over a sulfuric acid solution for a range of compositions. The technique employs the use of a time of flight mass spectrometer to sample the vapor phase above a sample through a molecular leak inlet. By calculating the response of the system to know pressures of molecular species of interest, the vapor phase partial pressures can be determined. Current work involves the completion of calibrating the system for SO2, SO3, and H2SO4. After calibration is completed, extensive studies of the partial pressures of these substances as a function of liquid phase composition and temperature will be undertaken.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

8.0005, NEUTRINO INTERACTIONS AT COSMIC RAY ENERGIES

R.E. Mickens, Fisk University, School of Liberal Arts, Dept. of Physics, *17th Ave. N. & Meharry Blvd., Nashville, Tennessee* 37203 (NSG 5297)

The objective of this research is to obtain estimates of the neutrino-nucleon total cross section at cosmic-ray energies. In particular, we are concerned with the energy interval 10-10 GeV. Recent studies on deep underwater muon and neutrino detection show that in the near future it may be feasible to perform experiments using such ultra-high energy cosmic-ray neutrinos. The design of these experiments will depend, in part, on the value of the neutrino-nucleon cross section; consequently, it is of some interest to have estimates of the neutrino-nucleon total cross estimates of the neutrino-nucleon total cross section over this energy range.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0006, OPTICAL CHARACTERIZATION OF ZERO-GRAVITY GROWN CRYSTALS

E. Silberman, Fisk University, School of Liberal Arts, Dept. of Physics, *17th Ave. N. & Meharry Blvd., Nashville, Tennessee* 37203 (NSG 8060)

Preliminary experiments performed in the micro-gravitational field of the Skylab and Apollo-Soyuz flights have shown the possibility of growing better crystals, as compared to the best that can be obtained on the Earth's surface. Further research on the potential of this space technology will be carried out in the Spacelab missions. The experiments have shown the need for better methods of measuring the physical constants of the new crystals. This proposal aims at developing a computerized-scanning-laser illuminated-photoelectrical ultramicroscope which could characterize degrees of crystal perfection. Measurements will be performed on the kind of crystals to be grown in the near future in Spacelab flights.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

8.0007, TURBULENCE IN TRANSIENT SOLAR PHENOMENA

M. Cross, Grambling State University, School of Arts & Sciences, Dept. of Physics, *Grambling, Louisiana* 71245

Recent advances have been made in the evolution of a fundamental theory of turbulence based on the physics of microscopic processes. The general use of models based on second moment closure schemes has been shown to be incorrect. In transitional flow, new parameters have been derived from kinetic theory which successfully characterize a variety of fluid and plasma systems with turbulent bursts and turbulence generated by amplified thermodynamic fluctuations. We propose to investigate the implications of these developments for transient solar phenomena. Specifically, we shall begin by extending the modern approaches for the study of unstable fluids to appropriately chosen periodic structures and bursting effects in the solar corona and interplanetary medium. We shall take full advantage of existing data on solar activity and use well established analytical procedures. From this, we expect to gain new insight into the physics of the sun. The cost to NASA for the first year of research would be approximately $30,000.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

8.0008, STUDIES OF NEW MEDIA FOR RADIATION-INDUCED LASERS

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The objective of this study is to search the laser material which would be suitable to solar pumped lasing. For a suitable solar pumped laser material, the following conditions are required: (1) good overlapping between solar spectrum and absorption spectrum of the laser medium, (2) broad band laser pumping mechanism, (3) efficient energy handover from energy storage medium to lasing medium, (4) low threshold to match a reasonable solar concentration (since solar radiation intensity has only 1.4 kWatts/sq. cm without any concentration service), (5) high power efficiency. The first laser medium we investigated was the iodine laser lasing at 1.315 microns. The iodine laser (usually lasing an organic compound CF3 I or C3FI) has broadband absorption from 250 microns to 290 microns and when flashed by xenon flashlamp, C3F3I or C3FI is photodissociated and produces an iodine atom in the P excited states.

In our preliminary study, the laser efficiency with respect to iodine pumping band was measured to be 3 percent. The solar radiation has low power density at the iodine laser pumping band. Therefore the buildup time is long. Iodine laser was also showing the laser action at the substantially higher temperature. This is encouraging because solar pumped laser will have to operate at higher than room temperature in order to make the laser medium absorb heat.

The further study of the lasing material will be centered around CF3I, IBr, NOCl laser for their compatibility for solar pumping mentioned earlier.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

8.0009, FEASIBILITY OF USING TEKTITES AND OTHER SPACE RELATED GLASSES FOR THE CONTAINMENT OF NUCLEAR WASTES

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Low temperature magnetic susceptibility measurements, extensive infrared spectra measurements, electron microscopy observations, electron microprobe analysis, Mossbauer spectra, and standard visual techniques will be used to determine if tektites or other space related glasses can be candidates for long term storage of nuclear waste materials.

The effects of radiation damage on the structure of these glasses will be examined by subjecting them to extreme amounts of radiation, and then performing magnetic, Mossbauer and infrared property studies which will determine if the basic glass structure has been affected. Infrared and electron microscopy studies of these glasses will be made before and after severe hydration, which will determine the amount of water contained and the progress of the water through the glasses. Further studies will be made by subjecting these glasses to many different high temperatures for various time periods and measuring the devitrification by use of the above standard solid state techniques. The results of these measurements will be extrapolated to long periods of time at ordinary temperatures.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0010, RESEARCH IN ELECTRON SPECTROSCOPY

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The objective of the research is the basic understanding of surface physics. The radiation damages of transition metal sulfides under ion bombardment have been studied by photoelectron spectroscopy. Under inert gas ion bombardment, decomposition to metal and elemental sulfur was observed. However, there is considerable difference between the dosages required to induce decomposition, differing by a factor of 200 between iron sulfide and copper sulfide. On the other hand, under oxygen ion bombardment, the predominant process appears to be ion-surface chemical reactions. Again, the dosages required for oxidation differ considerably. In particular, we note that the rate of ion-surface chemical reactions is inversely correlated with the rate of impact-induced decomposition. These results suggest systematics for radiation damages under ion bombardment.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0011, OPTICALLY PUMPED SUBMILLIMETER WAVES AND APPLICATIONS

J.M. Dutta, North Carolina Central University, School of Arts & Sciences, Dept. of Physics, *1805 Fayetteville St., Durham, North Carolina* 27707 (NSG 5120)

Recently there has been a greatly increased interest in far infrared spectroscopy of the atmosphere for the study of certain trace gas constituents of the upper atmosphere. Present investigations using conventional interferometric spectrometers have limited ability to separate the weak lines of trace gases from the dominant lines of other gases due to their poor resolving power. The proposed effort is to construct a tunable high resolution spectrometer based on a far infrared laser. A compact, stable FIR laser has been constructed and alternate stabilization schemes such as an optoacoustic technique are being tested. Various Schottky diodes and mixer structures are also being investigated for their suitability in a heterodyne spectrometer. Part of the proposed effort is the continuation of these investigations with the ultimate goal of constructing a high resolution far infrared spectrometer suitable for the study of trace gases present in the upper atmosphere.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0012, CRYSTAL STRUCTURE AND CATALYTIC PROPERTIES OF NOBLE METAL-RARE EARTH ALLOYS

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The catalytic properties of many noble metals can be improved by judicious rare earth additions. It is proposed in this project that the catalytic properties of two kinds of noble metal alloys be studied: (a) Noble metals containing trace amounts of rare earths, and (b) Noble metal-rare earth alloys with intermediate phases. Iridium, ruthenium, rhenium, platinum, etc. noble metals shall be alloyed with cerium, neodymium, etc. light rare earths and their catalytic properties in hydrogenation, etc. reactions studied. The types of crystallizations and phase equilibria in many of the noble metal-rare earth alloy systems are not known. It is also of interest to determine the crystal structures of intermediate phases in binary systems of selected rare earths with iridium, ruthenium, rhenium and platinum. This study is to determine the bonding behavior among transition metals of Group III and Group VIII and to establish the alloy theory for transition metal alloys.

A separate phase of the research program would look into the physical properties of these alloys, especially of those used in the catalyst study. The electrical resistivities of selected alloys shall be studied as a function of temperature in the cryogenic ranges. The effects of rare earth additions on the properties of the noble metals would be analyzed critically.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

8.0013, THERMODYNAMIC PROPERTIES OF SULFURIC ACID AT TEMPERATURES IMPORTANT TO THE ATMOSPHERE

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Our initial determination of the total pressure in equilibrium with highly concentrated sulfuric acid has now been reported. The values are in reasonable agreement with other recent ones reported by Roedel. Uncertainties in our low-temperature measurements were larger than expected, and an improved design has been completed to solve this problem. The new design will also allow measurements at lower temperatures. Construction of the partial-pressure-measuring device continues.

Our initial theoretical calculations used ideal gas assumptions. The results clearly showed their inadequacy. Theoretical techniques using statistical molecular theory have been designed to use the existing data to determine the pair correlation potential. Once determined, the pair correlation potential should reliably predict the thermodynamic properties of the acid at stratospheric temperatures. Our work, then, will not only focus on the total and partial pressures, it will also predict energies, entropies, and heat capacities (for example).

We will start the study of other sulfur compounds that may have a lower vapor pressure than sulfuric acid at stratospheric temperatures: dithionic, peroxi-di-sulfuric, and peroxi-mono-sulfuric acids.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

8.0014, SIZE EFFECT STUDIES OF THIN METAL FILMS

S.J. Brient, University of Texas, El Paso Campus, School of Science, Dept. of Physics, *El Paso, Texas* 79902 (NSG 3146)

Size effect parameters of thin metal polycrystalline films are to be obtained by direct comparison with their epitaxial form. The comparison will be made on a series of films of different thicknesses formed during the same evaporation. A high substrate temperature necessary to form the epitaxial films during evaporation while holding the polycrystalline films at room temperature will be made possible by using a split substrate holder with the two halves held at different temperatures. Attempts will be made to vary the upper film surface roughness as well as obtain experimental values of 'bulk' resistivity and mean free path. These values of resistivity, mean free path, and specularity parameter will then allow the polycrystalline films to be analyzed according to the Mayadas-Shatzkes theory. The split substrate system has been fabricated and temperature from 100K to 600K have been obtained while electrically contacting the films.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

8.0015, EXCITATION CROSS-SECTION MEASUREMENTS OF ATMOSPHERIC INTEREST

H.D. Morgan, University of the District of Columbia, Graduate School, *1025 Vermont Ave. N.W., Mt. Vernon Sq. Campus, Washington, District of Columbia* 20005 (NSG 5192)

Most of our research program consists of extending absolute emission cross section measurements of atomic nitrogen, atomic oxygen and hydrogen into the extreme ultraviolet (500-1100 angstroms), where there are few reported measurements in the literature. Such experiments will furnish useful results for further investigation of the earth's aurora, the day-glow planetary atmospheres and stellar spectra.

The design of the experiment involves the excitation of atoms by electrons in a chamber attached to the entrance slit of a normal incidence monochromator and the detection of photons by pulse counting techniques. An electrostatically focused electron gun is used to bombard the atomic species in the excitation chamber. Photons emitted by the atom pass through the entrance slit and are dispersed by a diffraction grating, then detected by a photomultiplier tube at the exit slit. The resulting pulses are stored in a multichannel analyzer which scans through each channel as the wavelength or voltage to the electron gun is varied with time. Two spectrums can be produced (intensity vs the wavelength or intensity vs electron energy). Cross sections of the excited states, the excitation mechanism and their minimum thresholds can then be determined from the spectra.

At the present the experimental apparatus has been fabricated and constructed. Emission cross sections resulting from electron impact on N2 and O2 have been remeasured and the results are being prepared for publication. Problems remain in determination of the atomic specie density used in calculating cross sections resulting from electron impact on atomic oxygen and nitrogen. Progress is being made in this area, but much remains to be done.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0016, CONTINUATION OF PARTIAL DISCHARGE TESTING/STUDY OF EFFECTS OF SURFACE CHARGING DUE TO GEOMAGNETIC SUBSTORMS

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The phenomena of high-voltage DC partial discharges is being investiated; this involves life testing of various electrical components commonly found on spacecraft. Also being investigated are the effects of DC discharges in vacuum. The effects of low-voltage DC discharges on spacecraft components is studied, using a high-resolution power supply. This will be followed by a study of effects on components of discharges due to voltages consisting of AC superimposed on DC; primary emphasis here will be on the laboratory feasibility of such a study.

A detailed investigation of various kinds of breakdown phenomena in semiconductor devices used on geosynchronous spacecraft is being made, with emphasis on the plasma approach (both solid-state and gaseous state). This involves a theoretical treatment based upon appropriate plasma and other models, coupled with experimental testing of said models, wherever feasible.

The effects of long-term electron bombardment on spacecraft electrical components is being ascertained in an effort to better understand the results of geomagnetic substorms on such components. The type and degree of possible damage to various exposed surfaces such as solar panels is being investigated; progress on testing of the TDRSS solar panel at Lewis Research Center is being monitored. Support will be given the effort to adapt all or part of the NASCAP computer code to the Goddard Space Flight Center computing system, in order to predict the electric potential in a magnetospheric environment and the resulting arcing from electrically active spacecraft.

Undertakings are joint active efforts involving personnel from the Goddard Space Flight Center, Lewis Research Center, and the University of the District of Columbia.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Goddard Space Flight Center

8.0017, MATERIAL SCIENCE AND SOLID-STATE PHYSICS STUDIES WITH POSITIVE MUON SPIN PRECESSION

C.E. Stronach, Virginia State College, Graduate School, Dept. of Physics, *Petersburg, Virginia* 23806 (NSG 1342)

This project utilizes the precession of polarized positive muons, and their parity-violating decay, to study properties of solids.

By measuring the precession rate of muons the magnetic field at interstitial sites in ferromagnets may be determined and the hyperfine contact field arising from conduction electron polarization may be extracted. Of particular interest is the variation in the hyperfine field with the introduction of various nonmagnetic impurities. Studies of Fe(Al), Fe(Mo), Fe(Nb) and Fe(Ti) suggest systematic variations occur as functions of the impurity type.

The rate of depolarization of the precession signal provides a measure of the diffusion rate of muons. Thus trapping of muons, which produces depolarization, can be observed and used to test for impurities, defects, dislocations, and strains. The depolarization rate of muons in low-temperature high-purity Al, for example, is very sensitive to the amount and type of impurities present.

These studies are continuing at the TRIUMF cyclotron. The next run is scheduled for November 1979.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

8.0018, MEDIUM-ENERGY NUCLEAR PHYSICS STUDIES

C.E. Stronach, Virginia State College, School of Science & Technology, Dept. of Physics, *Petersburg, Virginia* 23806 (NSG 1646)

This project utilizes medium-energy probes to study nuclear structure and reactions.

The primary emphasis is on studies of pion reactions in which coincidence events between outgoing charged particles and nuclear de-excitation gamma rays are observed. These coincidence spectra will enable us to distinguish, for example, between pion absorption and pion survival events. The spectra of charged particles should indicate for absorption events whether the pion's rest mass is shared by the nucleus as a whole, or whether the absorption process occurs with significant frequency upon smaller segments of nuclei. We anticipate performing a series of these experiments at the LAMPF LINAC in March 1980.

Another area of study is (p,d) reactions. Polarized protons and a magnetic spectrometer are used to measure differential cross sections and analyzing powers for deuteron production. The results are strongly dependent upon the j values of the final nuclear states, and suggest that (p,d) analyzing powers may allow reliable j assignments at intermediate energies and provide a valuable tool for identification of deep-hole strengths. We anticipate performing a series of these experiments at the TRIUMF cyclotron in December 1979.

Analogous experiments with photon and heavy-ion probes are under consideration.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

8.0019, CALCULATION OF TOTAL CROSS SECTIONS FOR CHARGE EXCHANGE IN MOLECULAR COLLISIONS

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Previous research accomplished under this grant included the theoretical investigation of low-energy collisions of nitrogen ions with nitrogen molecules. Theoretical developments and calculations reported in the literature were applied to experimental data obtained by Dr. Al Smith of the Instruments Research Division at NASA Langley Research Center. The application of these techniques to gas-gas/surface and gas-surface charge transfer collisions was also studied.

As part of their investigation of these reactions, experimentalists must select ions for mass and energy before the collision and analyze the same properties after. In order to increase the understanding of these devices, the 127 degrees cylindrical electrostatic analyzer and the quadrupole mass spectrometer were studied. Analytical expressions have been obtained for the transmission of the 127 degrees cylindrical electrostatic analyzer as a function of energy and two input angles for the entrance slit smaller than, equal to, and larger than the exit slit. Low-current selector and analyzer outputs for assumed energy and angle input distributions as well as broadening curves have been obtained.

A computer model of the quadrupole mass spectrometer has been developed. The path of an ion through the spectrometer may be calculated as well as the fraction of incident particles which are transmitted. The effects of fringing fields and of varying the pole piece separations (tilting the pole pieces) are being investigated.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

8.0020, SOLAR RADIATION MEASUREMENT PROJECT

J.W. Ioup, Xavier University of Louisiana, School of Arts & Sciences, Dept. of Physics, *7325 Palmetto St., New Orleans, Louisiana* 70125 (NSG 8050)

The purpose of this research project is to obtain measurements of the solar radiation incident at New Orleans. These measurements include the direct and the diffuse solar flux, the total amount of incident solar radiation per day with its distribution in time over the daylight hours, and infrared and ultraviolet data. Climatic measurements include temperature, barometric pressure, humidity, rainfall, and cloud cover, and atmospheric particulate measurements will be made of the correlation of these data with the insolation. The reliability and accuracy of instruments such as those using silicon photovoltaic cells will be tested by comparison with standard equipment. Data acquisition, storage, and analysis is performed under microcomputer control. Initial measurements are being made at the Xavier University campus with future data collection at various locations throughout the city and surrounding area.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

8.0021, ADSORBED FILMS, INTERFACES AND PHASE TRANSITIONS IN TWO AND THREE DIMENSIONS

D.L. Goodstein, California Inst. of Technology, Graduate School, Dept. of Physics, *1201 E. California Blvd., Pasadena, California* 91109 (DMR79-00827)

This research is a continuation of work supported under NSF Grant No. DMR77-00036. A comprehensive experimental program encompassing five distinct but interrelated projects concerned with films, interfaces and phase transitions will be undertaken. Nuclear magnetic resonance techniques will be applied to methane films in order to study the transmission and reflection of phonons at the vacuum interface of real crystals. A technique of combined thermodynamic measurement and analysis, previously applied to helium adsorbed on Grafoil, will be applied to new systems in order to investigate problems concerning two-dimensional matter.

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Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0022, MOLECULAR BEAM CARS SPECTROSCOPY

R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (CHE79-12673)

Professor Byer is supported by a grant from the Structural Chemistry and Thermodynamics Program and the Atomic, Molecular, and Plasma Physics Program to carry out detailed high resolution spectroscopic measurements. The major emphasis of Byer's work will be the study of pulsed molecular beams in order to enhance spectral and structural details for important molecular systems such as methane and sulfur hexafluoride. Thus, Byer will be combining state-of-the-art high vacuum technology with high powered laser systems to develop further the utility of coherent anti-Stokes Raman spectroscopy (CARS). The extension of high resolution CARS to sub-Doppler linewidths will provide precise absolute frequency measurements and improve considerably the resolution of complex spectra. A second area of study will be the Raman spectra of hydrogen and deuterium. The purpose of studying hydrogen in a molecular beam is to improve significantly the precision of the measured Raman vibrational frequencies and to verify the isotopic shift of the molecular vibration which is a direct test of the validity range for the Born-Oppenheimer approximation.

This research is a continuation of that currently supported by Foundation Grant, CHE-7621987.

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Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

8.0023, GENERAL RELATIVITY AND COSMOLOGY

R.K. Sachs, University of California, Berkeley Campus, School of Letters & Science, Dept. of Mathematics, *Berkeley, California* 94720 (PHY79-13146)

Research in theoretical gravitational physics initiated under NSF grant PHY77-1519A01 will be continued. Among the topics to be investigated are: 1) inhomogeneous cosmologies 2) particle production in cosmological models.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0024, HIGHLY NONLINEAR PHENOMENA AND PHYSICS OF CONFINEMENT

A.Y. Wong, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY79-08480)

A three-year program will systematically study three important topics in plasma physics. The first program involves highly nonlinear phenomena in plasmas, including the investigation of the generation and interaction of Langmuir solutions to verify the predictions of the nonlinear Schrodinger equation. The second program involves the conversion of electrostatic waves to electromagnetic waves. The electrostatic waves will be generated by the beam-plasma instability will also be studied. The third program involves particle transport in an axisymmetric magnetic field configuration with and without magnetic perturbations. In order to extend this study to the high temperature regime, a complementary university/industry collaboration effort will be carried out. Hughes Research Laboratories will develop high perveance neutral beam (2-5 keV, 50 amp) jointly with UCLA. This source is expected to raise the ion temperature in the Dodecapole to several hundred electron volts.

This is the fist year of a three-year continuing grant, a continuation of research begun under PHY7707160 A01.

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Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0025, STUDIES OF GAMMA RAY LINE EMISSION FROM ASTROPHYSICAL SOURCES

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This research will be concerned with theoretical studies of the high energy gamma-ray line emission from astrophysical sources. The following problems will be considered; 1) There will be a calculation of the deexcitation line emission spectra and individual line emissivities resulting from thermonuclear reactions at ion temperatures in excess of one billion degrees Kelvin. 2) There will be an investigation f the cross sections and luminosities of various neutron producing reactions which are important in such high temperature interactions. 3) There will be a calculation of the neutron and positron production rates in thermonuclear reactions at these temperatures. 4) Calculations will be made of the gravitationally and Doppler shifted gamma-ray line emission spectra which might be expected from various models of accretion around a neutron star or a black hole. 5)

There will be a comparison of these emission spectra with the gamma-ray line emission that has been reported from the galactic center and Centaurus A.

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of Astronomical Sciences

8.0026, SURVEY OF ATOMIC AND MOLECULAR SCIENCE

C.K. Reed, National Academy of Sciences, *2101 Constitution Ave. N.W., Washington, District of Columbia* 20037 (PHY78-25026)

The National Academy of Sciences, through its Committee on Atomic and Molecular Science (CAMS), will conduct a study and prepare a report to characterize the present state of research in atomic and molecular science. Included in the characterization will be information on numbers of research workers and nature of research activities, geographical location, types of research organizations participating, demographic information, training, and levels and sources of support. Universities, national laboratories, and industry will be surveyed. On the basis of such data the Committee will prepare a report on the status, health, and needs of the field.

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Sciences, Div. of Physics

8.0027, THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER

S.T. Manson, Georgia State University, School of Arts & Sciences, Dept. of Physics, *33 Gilmer St. S.E., Atlanta, Georgia* 30303 (PHY76-80123)

Research in theoretical atomic physics initiated under NSF Grant PHY72-05156 A01 will be continued. This research will focus on: 1. Investigate within the framework of Born approximation, the energy and angular distribution of electrons ejected by fast charged particle impact ionization of atoms. 2. Calculate, within the same framework, inelastic scattering form factors, generalized oscillator strengths, and energy loss cross sections for fast charged particle impact ionization of the atomic subshells of selected elements, as well as to determine their contributions to the total ionization cross section and stopping power. 3. Study the angular distribution of photoelectrons from open shell atoms, where the effects of anisotropic interactions play an important role, as well as other topics of interest in photoelectron spectroscopy such as satellite lines. 4. Explore the behavior of the cross section for the photoionization of selected excited states of various atoms. The results of the calculations will serve to provide further insight into the basic nature of these fundamental atomic processes which are of importance in plasma physics, atmospheric, solar, and astrophysics, radiation physics and for studies of the transport of energy from the site of thermonuclear reaction.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0028, A PROGRAM OF RESEARCH IN FAST ION SPECTROSCOPY

H.G. Berry, University of Chicago, School of Physical Sciences, *Dept. of Physics, 5801 S. Ellis Ave., Chicago, Illinois* 60637 (PHY78-27635)

Studies will continue of the interaction of fast atoms with thin foils, and of the processes involved as the atoms pass through the surface into vacuum. In addition, the scattering of atoms from surfaces at oblique angles will be studied. A model will be constructed to describe the collision processes involved.

This work is a continuation of that supported by NSF Grant PHY76-81960A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0029, SYNCHROTRON RADIATION STUDIES OF MATTER

F.C. Brown, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR76-20644)

High-resolution measurements of photoabsorption cross-sections will be extended to the carbon, oxygen, and nitrogen K edges in simple polyatomic gases. The experiments will be carried out using a new ultrahigh vacuum monochromator recently installed at the Stanford Synchrotron Radiation Project. The results will be compared with at threshold calculations of the highly excited states of molecules using ab initio theory. It is expected that the theory of extended absorption fine structures can be applied far above threshold. In addition, extreme ultraviolet photoabsorption experiments will be carried out at the Physical Sciences Laboratory, Stoughton, Wisconsin. These will include studies of the selenium 3d-level absorption threshold in layer type titanium di-chalcogenide crystals with controlled transition metal excess.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0030, HIGH-MAGNETIC-FIELD SUPERCONDUCTIVITY AND MAGNETISM IN TRANSITION METALS AND ALLOYS

R.R. Hake, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DMR77-10545 A02)

Research begun under NSF grant No. DMR7509940 will be continued and extended. A broad experimental program in the study of high magnetic field superconductivity in the transition-metal alloys will be undertaken and a major part of the program will involve the relationship between superconductivity and magnetism. Three areas of study are: 1) fluctuation effects and Type II superconductivity, 2) normal state electronic properties of disordered transition-metal alloys, and 3) spin glasses and Kondo systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0031, APPLICATION OF SOFT MODE ANALYSIS TO THE LATTICE DYNAMICS OF DNA AND RNA HELICES

E.W. Prohofsky, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR7820602)

Research previously supported by DMR7414367.

This project is a theoretical study of the dynamics involving mass displacement of the DNA and RNA helices. In particular those atomic motions which involve change in shape of helixes will be studied. Such changes in shape are brought about by changes in environment or by interaction with biological molecules. It is believed that these changes in shape are involved in the biological functioning of these macromolecules. The method used is that of soft mode analysis originally used to study displacive phase change in crystalline solids. The method involves calculating the onset of instabilities in the vibrational behavior of a system which leads to changes in shape. A necessary part of this project is the development of accurate models of the vibrational behavior of the helices. Methods will be developed and used on the refinement of the vibrations from observations of the infrared absorption and Raman scattering DNA and RNA. The effect of counterions and water of hydration on the vibrations as well as on the shape is to be investigated. The previous successful theory for the B to A DNA change is to be improved and extended to other DNA systems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0032, EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF INTERACTION OF INTENSE RADIATION WITH ATOMS

S. Ezekiel, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (PHY79-09739)

This research program is concerned with experimental and theoretical investigations of atom-field interaction and related phenomena. This includes the development of an ultra stable cw dye laser which is essential for probing the incredibly narrow features recently uncovered in multi-level interactions, the experimental study of the behavior of 3-level and 4-level system in weak and intense fields, theoretical studies of bistability which may lead to some experimental investigations, and some theoretical calculations of the behavior of multi-level systems in the presence of Doppler and collisional broadening. Finally, some high precision spectroscopy on a dense cold beam of hydrogen is proposed.

This research is a continuation of that previously supported under NSF grant PHY77-07156A01.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0033, SCATTERING SPECTROSCOPY OF LIQUID CRYSTALS

O.D. Litster, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-23555)

Liquid crystalline materials have phases with varying degrees of order intermediate between the total lack of long-range order in liquids and the nearly complete order of crystalline solids. The rich diversity of phases present in these systems affords an opportunity to elucidate the phenomenon of melting and to provide fundamental understanding of why various condensed phases of matter exist and have the properties they do.

Quasielastic light scattering from the normal modes resulting from long range orientational ordering is combined with ultra high resolution X-ray scattering spectroscopy to examine simultaneously positional ordering and its interaction with the orientational order of the molecules in smectic -A, smectic C, and the well ordered smectic B-like phases of liquid crystals. Picosecond time resolved spectroscopy is used to study molecular motion. Recently developed techniques in submicron technology will be used to study the interaction of liquid crystals with surfaces and to prepare well aligned samples of the various phases. The results are expected to provide valuable information on the properties of liquid crystals as well as insight into the role of symmetry and spatial dimensionality in determining which phases of condensed matter can exist in nature. They should be relevant also to lower dimensional physics. In particular, they should aid in understanding the phenomenon of melting in two dimensions. This is a continuation of work supported by DMR76 18035. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0034, *LIGHT SOURCE PROJECT*

W. Parkinson, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (31A-4A50-02)

Initiated plans to extend our atomic and molecular spectroscopy program to include quantitative measurements of the basic parameters of highly ionized atoms such as excited-state lifetimes, fluorescence decay branching ratios, wavelengths and collision and absorption cross sections. Initiated this work with a program to develop a new spectroscopic source of multiply ionized atoms that will possess several unusual features that are expected to eliminate many of the uncertainties that are associated with the more conventional sources. The new device will be built around a high-current hot-cathode oscillatory discharge ion source that was developed by G.S. Mavrogenes, W.J. Ramler and C.B. Turner at the Argonne National Laboratory as an adjunct to the design of a high-power heavy-ion cyclotron.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

8.0035, EXPERIMENTAL STUDY OF THE PHYSICAL AND ELECTRONIC PROPERTIES OF LIQUID TRANSITION METALS AND TRANSITION-LIKE METALS AND ALLOYS

J.B. Van Zytveld, Calvin College, Undergraduate School, Dept. of Physics, *1331 Franklin St. S.E., Grand Rapids, Michigan* 49506 (DMR79-09969)

Certain electronic and physical properties of solid and liquid transition metals and transition-like metals will be measured at high temperatures. Experiments include: measurements of resistivity and thermopower of the iron series transition metals from room temperature to above their melting points: measurements of resistivity and thermopower of solid and liquid europium and also the liquid allow strontium-barium; measurements of the density of liquid europium and ytterbium, and also of the liquid alloys magnesium-calcium, magnesium-strontium and magnesium-barium. These measurements will permit tests of recent theoretical work on the electronic and thermodynamic properties of liquid metal systems.

This is the first year of a three-year continuing grant; research was previously supported by DMR 7705213.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0036, IONOSPHERIC PLASMA PROCESSES

R. Sudan, Cornell University, Ithaca Campus, Lab. of Plasma Studies, *159 Sapsucker Woods Rd., Ithaca, New York* 14850 (DN980183; N00173-77-C-240)

The DOD is becoming increasingly dependent upon satellite systems for communication, surveillance and navigational purposes. It has become increasingly evident over the past few years that turbulent structure developing in the ionosphere can adversely affect the transmission of satellite signals. This affect manifests itself in fluctuations in the phase and amplitude of the transmitted signal. The objective of the current program is to assist in identifying the cause and characterizing the properties of the relevant ionospheric plasma turbulence. This information is needed in order to provide prediction of satellite systems performance.

Modern theories of strong plasma turbulence are employed to characterize turbulence in the ionized component of the E and F regions on the ionosphere. The results of these calculations are compared with numerical studies performed at NRL and with radar data taken in the field.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval
Research Lab.

8.0037, THERMAL CONDUCTIVITY OF CONFINED HELIUM-4 AT THE SUPERFLUID TRANSITION AND SPECIFIC HEAT OF HELIUM-3 ON THE SURFACE OF HELIUM-4

F.M. Gasparini, State University of New York, Buffalo Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *3435 Main St., Buffalo, New York* 14214 (DMR77-11325 A01)

This is a continuation and extension of research supported under NSF Grant No. DMR-7711325. Thermal conductivity experiments will be performed on liquid helium confined to dimensions of the order of, or less than, 200A. Such data obtained in the region of the lambda transition, will test current ideas with regard to finite-size scaling effects on the thermodynamical properties of this unique quantum fluid. Heat capacity studies of helium-3 films on the surface of helium-4 confined in 2000A nucleopore filters will continue. In this work a helium-4 film (30-50A thick) is initially formed, upon which helium-3 is deposited to produce a film between 0.05 and 1.0 atomic layers. These helium-3 films behave as two-dimensional gases and provide readily available systems for the use of specific heat techniques to study two-dimensional phase transitions–a topic of high scientific interest.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0038, PHYSICS AND TECHNOLOGY OF MATERIALS

N. Spielberg, Kent State University, School of Arts & Sciences, Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (SER78-00596)

Three new courses will be developed as an integrated introduction to materials science for Technology and other students, as well as for specialists. Prerequisites for these courses are one year of introductory physics and two quarters of calculus. The first course covers the application of selected concepts from modern condensed state physics to the electrical, magnetic and optical properties of solids. The second and third courses will deal with material science and physical metallurgy. The courses will be designed to maximize student comprehension of the ways in which basic physical concepts contribute to understanding and utilization of the technical properties of materials. The project calls for (1) intensive joint development by Physics and Technology faculty, review of applicable pedagogical material, and design of evaluation procedures during the first summer of the program; (2) teaching of the courses with ongoing evaluation and minor revision during the following academic year; (3) major revision as required during the second summer; and (4) a second round of teaching to establish the courses permanently in the curriculum. With the present student body makeup, 40 or 50 students per year will be served. The courses should also be suitable for evening and extension students. The detailed lecture notes and other material developed should be of value for ongoing use in these and other courses.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

8.0039, THEORY OF CRYSTALLINE ELECTRONS IN MAGNETIC FIELDS

G.H. Wannier, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR79-04837)

Research previously supported by DMR7706736.

Theoretical research on the behavior of the electronic structure of solids under the influence of a magnetic field. This theory is well understood in the weak and strong field limits. This research will deal with the problem in the intermediate region, i.e., between 10 Kilogauss and 10 Gigagauss. The theory will be developed with the aim of understanding the extra fine structure superimposed on the simple picture of an electron in a magnetic field. The difficulties of handling the irrational field case will be avoided by concentrating on the calculation of the density of states. Also, the possibility of approaching the problem by means of localized (Wannier) functions will be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0040, PROPERTIES OF THE GENERALIZED SCHOTTKY BARRIER

H.K. Henisch, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (INT77-04433 A01)

This research is concerned with metallic contacts on semiconductors and, in particular, with calculations relating to the properties of Schottky barriers. Traditional work in this area has involved many simplifying assumptions that are customarily introduced in order to make analytic solutions possible. In contrast, the complete transport equations can only be solved numerically by computer. The research in progress under this grant aims at such solutions for semi-infinite contact systems of arbitrary barrier height, barrier mobility ratio, barrier lifetime, and dielectric relaxation time, with special reference to the interaction between the barrier region itself and the bulk region immediately adjoining. Solutions free from these restraints have never been reported. The project also examines the consequences of current-dependent charges in surface states, and the special conditions which prevail at semiconductor-semiconductor contacts. These considerations are relevent to solar cell efficiency and its optimization.

The project represents the continuation of a collaboration between physicists and electrical engineers at Penn State University and the Venezuelan Institute for Scientific Research (previously funded by grant INT 77-04433 and the Venezuelan National Council for Scientific Research).

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

8.0041, PIEZO-OPTIC PROPERTIES OF CERAMIC MATERIALS

K. Vedam, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DMR76-82074)

This research will be concerned with two aspects of the piezo-optical properties of ceramic materials at high pressure, namely: (1) variation of the refractive index of solids with pressure to 100 kbars, and (2) variation of the optical rotary dispersion and circular dichroism in crystals with pressure. The materials to be studied include paratellurite (TeO2), hexagonal selenium, the gyroelectric material 5P50 3GeO2, and benzil. In all of these crystals, the desired optical absorption occurs at or near the visible spectrum, which should facilitate the experiments on effects of pressure and temperature on the optical properties.

The studies are of theoretical interest and also will be of value from the technological point of view, such as the development of suitable materials for a variety of acousto-optic device applications.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0042, EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE TRANSPORT PROPERTIES OF SEMICONDUCTING SURFACE INVERSION LAYERS

P.J. Stiles, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DN675521; N00014-76-C-0894)

As solid-state devices such as field-effect-transistors that are found in naval electronic systems become more compact and more surface oriented in their electrical transport behavior, they begin to be dominated by surface related effects. This program will seek to find better understanding of the surface related effects on the electrical properties of the compound semiconductor materials that make up the devices.

The investigators will seek a theoretical and experimental understanding of the physics of charge transport in compound semiconductor surface inversion layers. Experimental work will address the formation of good insulators on the surfaces and will characterize the transport in the surface inversion layer through mobility and magnetic transport effects. Theoretical studies will consider effects of exchange correlation, resonant screening, and final state interactions on the subband separation, and the effects of finite magnetic fields on effective mass and effective g value. A new consideration is the idea of surface channel tunneling as it relates to a FET device used to study subband properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of
Naval Research

8.0043, DYNAMIC MEASUREMENTS IN LIQUID CRYSTALS

S.V. Letcher, University of Rhode Island, School of Arts & Sciences, Dept. of Physics, *Kingston, Rhode Island* 02881 (DMR79-06785)

Knowledge of the properties of liquid crystal phases and of the ion transitions between them has increased dramatically over the last decade. Many aspects of their dynamical properties, especially near phase transitions, remain unclear. For example, both theoretical and experimental studies have yielded contradictory results for shear viscosities near phase transitions. Further careful experiments on dynamical properties, therefore, are needed.

In the present work are studied the shear properties of oriented liquid crystal phase. Particular attention is given to the dynamics of the smectic A-smectic B phase transition and to the reentrant nematic phase. The former problem has been stimulated by the apparent similarity of the A-B transition to two-dimensional melting and the recent theoretical advances in that field. Shear impedance changes and shear stresses at very low rates are measured. Measurements of the anisotropic viscosity of the reentrant nematic and its relation to those of the high temperature nematic and intermediate smectic phases promise to be a good test of the model for that system.

Renewal of work supported by DMR77-07813.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0044, REACTIVE COLLISION PROCESSES INVOLVING ATOMS, MOLECULES AND SURFACES

N.F. Lane, Rice University, School of Natural Sciences, Dept. of Physics/Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (C-540)

Theoretical calculations have been performed of rates and cross sections for a number of collision processes involving molecules, atoms, and electrons in gases and near metal surfaces. These rates are important in the kinetic modeling of laser media and high- and low-temperature plasmas. The theoretical studies include: vibrational and rotational energy-transfer in electron-CO2 collisions; determination of the effects of plasma screening on inelastic electron-ion scattering in high-temperature, high-density plasmas; extension of charge-transfer studies in He ions collisions with atomic hydrogen to include 'continuum' correlation effects; energy transfer in collisions of excited atoms and molecules with metal surfaces; energy transfer in slow collisions of exited- and ground-state rare-gas atoms; self-consistent LCAO/MO (local exchange) calculation of energies and wave functions for H in a nickel crystal. A new theoretical program has been initiated to study: (1) inner-shell photoionization of large molecules by a hybrid R-Matrix/Multi-Scattering approach, and (2) electronic excitation of molecules (and molecular crystals) by 'Super-thermal' neutron scattering.

SUPPORTED BY Robert A. Welch Foundation

8.0045, ROCKET-BORNE STUDY OF AURORAL ELECTRIC FIELDS AND CURRENTS

E.A. Bering, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (ATM77-21462 A01)

Data on the electrodynamic structure of the aurora borealis taken during the flight of sounding rocket Terrier-Malemute 29.007 UEX will be analyzed. The data include measurements of the DC electric field, AC electric field, plasma density and plasma temperature. Correlations and comparisons will be made with a variety of data from other instruments on the rocket and from ground based sources. The rocket trajectory carried over an auroral arc and, thus, good data was obtained on an important auroral form. The overall aim of the research is to deduce the particle behavior, current density on electro-magnetic fields associated with the arc.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

8.0046. CONJUGATE MAGNETOSPHERIC ELECTRIC FIELDS, MAGNETOSPHERIC ULF RADIATION, AND MODULATIONS OF ELECTRON PRECIPITATION (ABBREV)

E.A. Bering, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP79-09236)

Five electric field detectors will be constructed and added to the University of Maryland's X-ray balloon payloads planned for flight from Siple Station, Antarctica, in January 1980 to study interactions of very-low-frequency and ultra-low-frequency waves with particles in the magnetosphere.

The data obtained by the electric field detectors on these flights will be used to investigate the interaction between energetic electron precipitation and ultra-low-frequency waves.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

8.0047, THEORETICAL INVESTIGATION OF INVERSION LAYERS IN METAL-OXIDE-SEMICONDUCTOR INTERFACES 15873-P

C.S. Ting, University of Houston, School of Natural Sciences & Mathematics, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DA0G9030; DAAG29-79-C-0039)

To study the subband energy levels of the metal-oxide-semiconductor interface Auger-type transitions affecting infrared optical absorption involving these levels, their temperature dependence, the consequences of intervalley electron-electron scattering on electron mobility, and the dependence of effective quasi-particle electron mass on the density of sodium ions drifted to the interface as evidenced by cyclotron resonance. Relevance - improved understanding of these interfaces found in field-effect transistors widely used in military and industrial devices has the potential of significantly impacting the future of semiconductor device technology.

The Green's function method of many-body theoretical physics will be used, particularly involving the random phase approximation and the memory-function formalism.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel
Development & Readiness Command,
Army Research Office

8.0048, HIGH-PRESSURE PHASES OF COPPER CHLORIDE AND HIGH TRANSITION TEMPERATURE SUPERCONDUCTORS

C. Chu, University of Houston, School of Pharmacy, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DMR79-08486)

This research is a continuation and extension of work supported under NSF grant No. DMR-7723204. A broadly based experimental program involving the use of ultra-high pressures and low temperatures will investigate the electrical, magnetic, thermal, optical and superconducting properties of a variety of alloys and compounds. Initial efforts will concentrate on a detailed study of the high pressure phase of copper chloride. Concomitant with this work, will be a study of the effect of ultra-high pressures on the magnetic properties of metallic elements and compounds as well as on the ternary molybdenum chalcogenides.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0049, ANOMALOUS SOUND PROPAGATION IN METALS

J.D. Gavenda, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR78-25232)

The recently discovered phenomenon of anomalous sound propagation in copper by conduction electrons in extended orbits will be studied by measurements with various geometries of ultrasonic wave vector and polarization. The dependence of this phenomenon on the properties of the Fermi electrons in different metals will be investigated and a quantitative theoretical model will be developed on the basis of the experimental results. Phases of the project will include: 1. the determination of the validity of pulsed-ultrasonic experimental data in the presence of extended-orbit resonances, 2. a better understanding of the mechanisms involved in direct generation of ultrasound by electromagnetic fields, 3. the reduction of ambiguity in the interpretation of magnetoacoustic data, 4. the possible explanation of anomalous microwave propagation by open-orbit electrons, and 5. the possibility of ultrasonic amplification through coupled extended-orbit resonances. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Materials Research

8.0050, TOPICS IN THEORETICAL PHYSICS

C.E. Carlson, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Physics, *Ewell Hall, Williamsburg, Virginia* 23185 (PHY79-08240)

Research will be done in theoretical physics to enhance our understanding of elementary particles and of the nucleon-nucleon interaction in nuclear physics.

The theoretical problems to be investigated concern the hadronic production of charmed particles, extraction of Gen from elastic e-d scattering data, calculation of the long range nucleon-nucleon interaction from quark confinement models, and determination of the sign of the NN interaction at short distances.

This is the first two years of a four-year continuing grant, previously supported under NSF grant PHY77-07409.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0051, THEORETICAL MEDIUM ENERGY NUCLEAR PHYSICS

J.V. Noble, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (PHY79-01672)

This work is in the field of theoretical physics, with particular emphasis on study of nuclear interactions. Specific topics which will be examined include: 1) Implications of wave function orthogonality for improved DWBA calculations. 2) Relativistic effects in medium energy reactions. 3) Characterization of nuclear collective motions in terms of coupled meson and nucleon fields. 4) Relativistic three body dynamics. 5) Measurement of the mesonic component of nuclei.

This is the first year of a three year continuing grant, previously supported under NSF grant PHY76-84374A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

8.0052, U.S.-U.S.S.R. COLLABORATIVE PROJECT IN ATOMIC PHYSICS

R. Geballe, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (PHY76-24196 A01)

Diagnostic equipment for atomic beams studies will be provided. This equipment is necessary for the research program already initiated under this grant, which will study photodetachment of certain negative ions.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Physics

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, LANDSAT STUDY OF URBAN CHANGE IN JACKSON, MISSISSIPPI

M. Lang, Jackson State University, School of Liberal Studies, Dept. of Social Science & Educational Geography, *1325 Lynch St., Jackson, Mississippi* 39217 (NSG 736)

This project has three components: 1) Applied research utilizing Landsat data for monitoring, assessment and analysis of changing land use patterns along an interstate highway beltway in Jackson, Mississippi. 2) Development of Landsat data analysis capabilities at Jackson State University. 3) Establishment of research ties among geographers at predominantly minority institutions to encourage the use of Landsat data in research and instruction at their respective college or university.

PROGRESS/CURRENT PLANS: Planning and initial efforts are underway in the research phase of this project. Landsat imagery of the study area, collected during 1976 and 1978, has been obtained and analysis has begun. Field studies to be used for verification of the Landsat data have been initiated. Finally, efforts are underway to augment existing central computing facilities at Jackson State University to allow for analysis of digital Landsat data.

During October 1979 a workshop was held at Jackson State University. The purpose of the workshop was to bring together geographers from predominantly minority institutions to discuss ways of improving geography programs at these universities. Participants outlined research topics which could be undertaken jointly. These included: 1) Geographic and social impacts of community development efforts in major urban areas of the South. 2) Economic impact of loss of black owned farmland in the South - using Landsat data. 3) Changing ethnic residential patterns in major cities of the South.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Headquarters

9.0002, STUDY OF GENERALIST VERSUS SPECIALIST CONCEPT IN PERSONNEL MANAGEMENT

C. Sampson, State University & Community College System of Tennessee, Tennessee State University, School of Arts & Sciences, Dept. of Political Science, *Nashville, Tennessee* 37203 (NAS 9-15862)

Effective personnel administration, i.e., the procurement, development, and utilization of an organization's human resources is the key to successful management. Regardless of what product or service an organization provides and no matter what size, age, or location, it must procure human resources to remain viable. Further, if the organization is to survive, it must design programs to develop human resources to their fullest capacities and maintain ongoing worker commitment.

The practice of personnel administration faces three general demands. First, it must help the organization cope with a changing environment, with constraints and opportunities developed externally, such as those stemming from public law and labor unions. Second, it must cooperate with other line and staff areas to achieve the organization's goals. It must secure the respect, trust, and confidence of the members of these units in order to effectively implement its programs. Third, it is required to respond to certain serious human resource management problems organizations face.

This study will examine all areas considered in a 1968 study of the JSC personnel organization, and will compare JSC with other agencies. It will examine the role of the Personnel Management Specialist in contemporary generalist and specialist operations. These two approaches will be compared and contrasted, and their relevance to JSC will be analyzed. Included in the report will be a discussion of the impact of the revamping of the Civil Service Commission.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

9.0003, SPACE FLIGHT DESIGN AND DEVELOPMENT STUDIES

H.E. Blackwell, Texas Southern University, School of Arts & Sciences, Dept. of Physics, *3201 Wheeler Ave., Houston, Texas* 77004 (NAS 9-16054)

The contract includes work in two areas. Initially, effort will be concentrated on the review, criticism, testing as required, and preparation of course material for training of flight design paraprofessionals. The course materials will be developed from initial materals prepared at JSC. Periodic reviews will be scheduled for the purpose of discussing progress and problems. The goal is a modular set of instructions incorporating innovative educational techniques which can be used with minimum preparation time by the instructor, and which will insure consistent training for all students.

The second phase will be preliminary development of a remote manipulator arm real-time simulator. TSU will review engineering data and algorithms, devise improved algorithms if required, and implement these algorithms into a university computer facility. Technical exchanges and reviews will be scheduled on a regular basis. The long-range goal is a system which could be used for training and flight design.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

9.0004, AN EVALUATION OF THE LANGLEY LEARNING CENTER

A.E. Boese, Virginia State College, Graduate School, Dept. of Economics, *Petersburg, Virginia* 23806 (NAS 1-16079)

N.A.S.A.-Langley has established a Learning Center as an alternative educational method to supplement its employee training efforts. This method of training offers employees individualized learning in those instances where it appears to be more convenient, meaningful, and cost effective.

The objective of Virginia State University's contract with N.A.S.A. is to evaluate the effectiveness of the training function of the Learning Center. This evaluation will be made possible through four related projects: (1) The development and validation of a means of surveying the job related training needs of the Langley Research Center. (2) The development and validation of a means of evaluating the learning experience of Learning Center participants. (3) The development and validation of a means of surveying employee satisfaction with the Learning Center. (4) The development and validation of a method of evaluating the value of the Learning Center in relation to the total Research Center.

The study is intended to eventually help increase the effectiveness of the Learning Center, and the productivity of the participants and the Research Center.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, USE OF THE CHAPPUIS BAND FOR DETERMINATION OF MODERN AND HISTORICAL STRATOSPHERIC OZONE LEVELS

R.J. Angione, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Astronomy, *5402 College Ave., San Diego, California* 92115 (NSG 1430)

A program is underway to optimize observations and data reduction techniques to use absorption of sunlight by the Chappuis band for the determination of contemporary and historical amounts of ozone in the earth's stratosphere. Observations made by the Smithsonian Institution's Astrophysical Observatory during the period from 1905 to 1955 are being analyzed to produce long-term baselines for Table Mountain, California, and Mount Montezuma, Chile. Shorter length baselines will be determined for seven other sites in North and South America and Africa. Ozone amounts will be reported on an absolute scale that is independent of, but comparable with, results from Dobson spectrophometry. Modern observations in the wavelength range 0.40 to 0.95 microns are being made of the sun during the daytime with a filter wheel radiometer and of bright stars at night with an existing astronomical telescope and photometer.

The filter wheel radiometer was taken to Mauna Loa Observatory and intercompared with the Dobson. The Chappuis band results were systematically lower by 0.17%. To date we have baseline ozone measurements from 1920 to 1950 for Table Mountain, California, and Mount Montezuma, Chile.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

10.0002, THEORETICAL STUDIES OF SOLAR WIND DYNAMICS

T. Kilpatrick, California State University & Colleges, San Francisco State University, School of Science, Dept. of Physics & Astronomy, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660806)

The hot outer atmosphere of the sun expands supersonically into interplanetary space. This hydrodynamic flow, called the solar wind, streams past Earth causing such effects as the northern and southern lights, magnetic storms, and perhaps influencing the weather on the Earth. However, the physical mechanisms which act to heat and accelerate high-speed streams in the wind have not been clearly elucidated. Hydromagnetic waves can transfer momentum to the wind, and large fluxes have been observed in high-speed streams by spacecraft borne instruments. The proposed research will examine the role that hydromagnetic waves play in the acceleration and heating of the solar wind. The results of these investigations will be reported in published papers.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, IRRADIATION EFFECTS ON SURFACE OF THE MOON, MERCURY, ASTEROIDS & OTHER AIRLESS SOLAR SYSTEM BODIES DUE TO SOLAR HIGH ENERGY & COSMIC RAYS

M.S. Spergel, City University of New York, York College, Undergraduate School, Dept. of Physics, *150-14 Jamaica Ave., Jamaica, New York* 11432 (NSG 7454)

Under study is both the feasibility of determining planetary composition by remote sensing of galactic cosmic ray induced gamma rays and the prediction of rare earth abundances within the lunar soil. Investigations of secondary neutrons induced in the lunar soil and in planetary and cometary soils have indicated that the energy spectra of the neutrons and their secondary gamma rays are determined principally by the soil composition.

Various production mechanisms for the induced neutrons were considered. The neutron flux is then calculated using a 100 energy group neutron transport code. The calculations are carried out in collaboration with Drs. P.W. Levy and O.W. Lazareth of Brookhaven National Laboratories and utilize recent neutron and gamma ray cross sections. The calculations were performed assuming isotopic and anisotopic neutron scattering.

The gamma ray fluxes were calculated from the neutron flux distributions generated by the galactic cosmic rays primaries. The gamma ray fluxes use a transport code.

It would appear that galactic cosmic ray fluxes will produce a gamma ray flux at the surface that is measurable by 'state of the art' instrumentation. In fact, if values of 10 minus to the 6th power ph/sq. cm Mev sec Str are measurable, it should be possible to measure the induced gamma rays out to 30 lunar radii from a surface.

Soil composition, rather than the characteristics of the secondaries appear to be the dominant factor shaping the gamma energy flux. The prompt gamma ray energy spectrum appears to contain prominent maxima indicative of certain nuclei. Thus, the prompt gamma ray flux measurements may provide a practical technique for determining soil composition in fly-by missions.

The study is continuing to examine the variation of secondary flux for compositional variation.

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0004, THEORETICAL PROBLEMS OF SPIRAL GALAXIES

C. Yuan, City University of New York, City College, Graduate School, *Convent Ave. & 138th St., New York, New York* 10031 (NSG 2348)

The density-wave-theory has proven to be the most successful theory of explaining the spiral structure of disc galaxies. One objective of the present research is to further strengthen the theory by solving the eigen-value problem recently formulated by Lin and Lau to find spiral modes of density waves. The short-range goal is to develop a numerical method which is capable of calculating eigen-values and modes for a large class of galactic models. In particular, we are interested in confirming the asymptotic theory put forward by Lin and Lau and obtaining the spiral modes for the Milky Way. The long-range goal of this study is to establish a dynamical classification of spiral galaxies. The problems of discretizing the singular integral equation of the Poisson's type and treating the radiation boundary condition at infinity are resolved. We are in the process of establishing methods to search the eigen-values of a complex algebraic system.

The second objective of the research is to study the evolution of the abundance distribution of the gas in spiral galaxies, especially for galaxies like the Milky Way which has an inner Lindblad resonance. The gas will redistribute itself in the course of time as it is continuously depleted into star formation by the triggering mechanism of the large-scale shock along spiral arms. We shall use the Godunov Method to solve the gas dynamics equations with the mass loss derived from the density-wave theory. The first order numerical scheme which can handle the geometric singularity at the center and the source terms is being developed. Our immediate aim is to obtain the time-dependent axisymmetric solution. However, we intend to extend the problem to two dimensions in the future.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

10.0005, THEORETICAL STUDIES OF AURORAL AND MAGNETOSPHERIC PHENOMENA

D.W. Swift, University of Alaska, Fairbanks Campus, Geophysical Inst., *Fairbanks, Alaska* 99701 (ATM77-14897 A01)

This grant will support a broad range of theoretical studies directed toward answering fundamental questions about the auroral magnetospheric substorm and the mechanisms of energy flow from the solar wind to the aurora. The work will consist of an interplay of analytical studies and numerical modelling of plasma processes.

Specific projects planned are: 1. an investigation of the mechanism for the development of large localized potential differences across magnetospheric field lines; 2. an investigation of energy transfer processes through the northern and southern boundaries of the magnetospheric tail; 3. an improved V-shock model to calculate perpendicular energization of oxygen ions; and 4. an investigation of wave-particle diffusion processes in auroral electron beams.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0006, PLANETARY GEOSCIENCE CONSORTIUM

L.A. Soderblom, U.S. Dept. of the Interior, Geological Survey, Branch of Astrogeologic Studies, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01327)

Although the primary emphasis is shifting away from lunar studies to other planets, two lunar activities will continue. First, Wilhelms will complete his two-year effort to compile a new map of the maria based on all available consortium data and second, phase-angle-color studies by Soderblom will be finished. The prime emphasis will be to collect and reduce a variety of Mercury and Mars data coming available (crater density, color variation, geology, for both; IRTm, MAUD, geomorphic and structural maps, gravity and others for Mars). Additionally, pilot studies will begin late in FY 79 for reduction, portrayal and correlation of Venus Pioneer and Voyager data.

SUPPORTED BY U.S. Dept. of the Interior, Geological
Survey, Geologic Div.

10.0007, SEARCH FOR LOW MASS COMPANIONS OF SOLAR-TYPE STARS USING A FABRY-PEROT SPECTROMETER

K.M. Serkowski, University of Arizona, Lunar & Planetary Lab., Dept. of Planetary Sciences, *Tucson, Arizona* 85721 (AST78-23107)

Since August 1977 an echelle spectrometer with a Fabry-Perot wavelength calibration has been in operation on the Catalina 154-cm telescope. It has measured stellar radial velocities with accuracy of about plus or minus 30m/sec, considerably higher than conventional instruments. The instrument is used for a search for low-mass (0.001 to 0.1 solar mass) companions around solar-type stars. The purpose of this search is to detect the Jupiter-like planets and to estimate the frequency of single stars among solar-type stars, essential for estimating the frequency of extrasolar planetary systems and for explaining the origin of the solar system.

It is planned to include in the search all those 52 solar-type stars brighter than V equals 5.5 mag. for which Abt and Levy did not find evidence of duplicity or multiplicity. The present Digicon detector will be replaced by a 342 x 42 element intensified CID array, permitting observations of 9 echelle orders simultaneously and therefore increasing the limiting magnitude of the radial velocity meter to V equals 6.0 mag. A laser calibration will be installed which should increase the accuracy of the radial velocities to above plus or minus 15m/sec for a single observation.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, SPECTROSCOPIC STUDIES OF QUASISTELLAR OBJECTS

P.A. Strittmatter, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST77-23055 A01)

A wide variety of projects have been investigated in order to understand the nature of the line-formation regions in quasistellar objects (QSO's). In the past years discoveries have been made that certain absortion systems with redshifts both greater and much less than the emission redshift must originate at distances so far from QSO's that the absorbing material cannot be directly associated with the quasar. In addition, the results of studies of absorption in low-redshift QSO's are consistent with the redshifts originating in intervening galaxies. Certain Seyfert galaxies and HII regions have been studied and interesting discoveries concerning the nature of the continuum radiation from the nucleus of the galaxy NGC 1068 and the hot star lambda Ori A were made.

The spectroscopic work on low-z QSO's will be continued for the next two years in order to find absorption systems that may arise in intervening galaxies which can be directly photographed in the red region of the spectrum and studied spectroscopically. Absorption systems in high-z quasars will also be observed at high resolution in order to determine element abundances and whether line-splitting is caused by radiation pressure ('line-locking'). Emission-line regions will be modeled theoretically in order to determine whether the line profiles can be accounted for in terms of radiation pressure. Finally, low-dispersion work on the identification of Molonglo sources will be continued, as well as the initiation of a new discovery program of radio-quiet high-redshift QSO's using a converging beam transmission grating. This is a continuation of grant AST 76-22991.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, OBSERVATIONAL PROGRAM IN GROUND-BASED INFRARED ASTRONOMY

G. Neugebauer, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST77-20516 A01)

An infrared astronomy program using the telescopes of the Hale Observatories will be carried out. The program emphasizes the unique capabilities of the 200 inch telescope--high spatial resolution with high signal-to-noise–combined with high-sensitivity photometric equipment developed over the past years. Highest priority will be put on high spatial resolution studies of galactic nuclei and point sources using the 200 inch; this can determine size structure with an uncertainty of approximately 0.1". An increasing emphasis is being placed on high spatial resolution, medium spectral resolution spectroscopy. The telescopes at Las Campanas, Chile, and Mauna Kea, Hawaii, will also be used.

The specific scientific programs which will be emphasized include the continuation of the study of molecular hydrogen with high spatial resolution. The systematic study of the infrared energy distributions of quasars will be continued along with low-resolution spectroscopy to identify atomic lines which are redshifted into the near infrared in comparison with lines which are redshifted into the visible. Several extragalactic and galactic ionized hydrogen (H II) regions will be studied in addition to the observations of regions of star formation within the Galaxy.

This is a continuation of research begun under NSF grant AST 74-18555 A2.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, LABORATORY STUDY OF NEUTRAL POINT SOLAR FLARE PROCESSES

R.S. White, University of California, Riverside Campus, Inst. of Geophysics & Planetary Physics, *Riverside, California* 92502 (ATM76-23463 A02)

The primary objective of this grant is the experimental investigation of the dynamic behavior of plasmas in the neighborhood of an x-type magnetic neutral point, and the process of reconnection of magnetic field lines. The purpose of this effort is to clarify the physical processes that take place in solar flares, substorms of the earth's magnetosphere, and other manifestations of plasma dynamic behavior and field line reconnection in complex magnetic field systems containing x-type magnetic neutral points.

The investigators will study magnetic field line reconnection with a flat plate Double Inverse Pinch Device (Mark IV) and three-dimensional, double-dipole configurations. They measure the fluxes and energy spectra of accelerated ions and electrons, optical, microwave, and X-ray radiations, the magnetic field line configurations, reconnection rates, and energy dissipation rates. A major effort will be made to determine the conditions required to produce the remarkable transitions from ohmic to turbulent conductivity which have been observed. These sudden conduction mode transitions produce many phenomena that correspond to those in solar flares and magnetospheric substorms.

The overall aim of this work is to understand the process of magnetic reconnection and how it relates to realistic models of the solar flare and the magnetosphere substorm.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0011, AN INVESTIGATION OF MAGNETIC FIELDS IN PROMINENCES AND FLARES

J.M. Malville, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (ATM78-25059)

This grant will support an investigation of the role of magnetic fields in solar prominences and flares based largely upon data obtained with the Kitt Peak National Observatory (KPNO) magnetograph. Observational material which has already been obtained includes helium line magnetograms of disk filaments and hydrogen line magnetograms of limb prominences, both with spatial resolution approaching one second of arc. Major themes of the study will be the association between velocity fields and magnetic fields, electric current systems in the low corona, and the development of flare-like current sheets in prominences. New observations are measurements of magnetic fields in limb flares and high time resolution studies of flare-like events in prominences. The overall aim is to understand the magnetic/electric character of solar activity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Atmospheric Sciences

10.0012, INSTRUMENT FOR LONG DURATION OBSERVATIONS OF SOLAR P-MODE OSCILLATIONS

R.F. Howard, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST78-20404)

This grant will support the purchase of data reduction and analysis equipment to be used in a program of seismic probing of the structure of the sun. Specifically, the motions of the surface of the sun will be measured on a regular basis in order to derive the variations with time of the rate of rotation of the surface and subsurface layers of the sun. In addition to studying solar rotation these observations will permit an investigation of other aspects of solar velocity fields such as possible acoustic oscillations generated by solar flares, meridional flows and variations in frequency and amplitude of the newly discovered p-mode oscillations. Such observations will improve our knowledge of how solar variations affect our terrestrial environment.

The equipment will be used in conjunction with the 60-foot solar telescope on Mt. Wilson with which the five minute oscillations of the sun were originally discovered. Practically all the observing time available on this instrument will be dedicated to this program. Large blocks of observing time are necessary to the success of the project. The proposed data acquisition and analysis system will have the necessary speed and capability to collect and store large amounts of data and to carry out the required data reduction tasks which are central to this project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0013, OBSERVATIONAL STUDIES OF THE ATMOSPHERES OF EARLY-TYPE STARS

S.C. Wolff, University of Hawaii System, Manoa Campus, School of Arts & Sciences, Dept. of Astronomy & Physics, *2444 Dole St., Honolulu, Hawaii* 96822 (AST77-27404 A01)

The analyses of the spectra of early type stars are essential to studies of galactic structure, interstellar matter, stellar nucleosynthesis and evolution. Within the last decade our understanding of atmospheric structure and line formation processes has reached the point where it appears possible to use the observed spectra to obtain reliable diagnostics of the conditions prevailing in the atmospheres of these early stars. This research will be devoted to carrying out an observational program designed to provide photoelectric measurements at high resolution of the spectrum of such stars. A study of the line profiles due to elements such as hydrogen, helium and carbon will be made in order to test the model atmosphere calculations, to provide data which will be used as an input for further improvements in the theoretical models, and to take advantage of the calculations already made to determine atmospheric parameters, rotational velocities, and helium abundances for early type stars.

This is a continuation of work originally supported under NSF grant AST77 27404.

SUPPORTED BY U.S. National Science Foundation,
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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, POSITIONAL STUDIES OF MINOR PLANETS

H.J. Wood, Indiana University, Bloomington Campus, Graduate School, *2805 E. 10th, Bloomington, Indiana* 47401 (AST79-08911)

Support is to continue a long-term scientific service project for positional and magnitude measurements of minor planets down to the 17th magnitude. In the program, 6,300 astrographic plates were accumulated using a 25cm astrograph during the period 1948-1966. Presently, positions are being measured on request for those objects which need orbit improvements to facilitate modern astrophysical observation or for those objects which may become 'critical', in danger of being lost because of poorly-known orbital elements. The Indiana Minor Planet Center responds to requests for astrometric positional measurements from scientists all over the globe. Dr. Brian Marsden at the Smithsonian Astrophysical Observatory, who coordinates the activities of several observatories through the International Minor Planet Center is the major user of astrometric positions of minor planets measured at Indiana. In addition, Dr. Paul Herget has developed a new program at Cincinnati to find newly discovered minor planets on plates where they were missed earlier. Professor Herget's program is a new source of requests for blinking and measurement on the astrographic plates. Indiana has the largest asteroid plate collection in the United States and thus provides a valuable service to groups active in minor planet research.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0015, CONTINUED SURVEYS FOR EMISSION LINE OBJECTS

T.J. Bohuski, Western Kentucky University, School of Science & Technology, Dept. of Physics & Astronomy, *Bowling Green, Kentucky* 42101 (AST78-01375)

The first part of the project will be a survey of emission line galaxies in the Hydra I and Centaurus clusters in an attempt to determine the luminosity function of such objects down to an absolute magnitude of M equals minus 13. Since many emission line galaxies appear to be experiencing a high rate of star formation, such data is useful for studying the time-dependence of the star formation rate within galaxies. The purpose of part two of this project is to examine the question of how the discovery rate of quasars depends on differences in the observers, the equipment used, and the identification criteria. Substantial variations in the discovery rate do appear to exist and understanding of why they do is necessary to a proper interpretation of quasar statistics. An objective prism survey of a region that is being surveyed independently by another group of observers will be carried out to find out how the discovery rate of quasars depends on the equipment used and other factors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
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of Astronomical Sciences

10.0016, INFRARED STUDIES OF PRE- AND POST-MAIN-SEQUENCE STARS

S.G. Kleinmann, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST78-27639)

This research will be devoted to observational studies of regions of active star formation. These studies will be based upon sources found in the United States Air Force mid-infrared sky survey. In order to provide detailed models of star formation, observations will be made aimed at determining the positions on the Hertzsprung-Russell diagram of objects evolving towards the main sequence and the density, temperature and velocity structure of matter surrounding the protostar. The observations will be made at the Kitt Peak National Observatory.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, THE GALACTIC DISTRIBUTION OF INTERSTELLAR ABSORPTION

R.J. Davis, Smithsonian Institution, Astrophysical Observatory, Optical & Infrared Div, *60 Garden St., Cambridge, Massachusetts* 02138 (310-4050-05)

OBJECTIVE: Obtain an improved determination of the galactic distribution of interstellar dust, and of variations in its extinction properties, in the wavelength range 1300 to 6000 angstroms.

SECONDARY OBJECTIVE: To complete the identification of stars having peculiar photometric properties in the above wavelength range, based on UBV, H-beta, and the Celescope ultraviolet photometry.

APPROACH: Obtain UBV and H-beta photometry for all stars in the Celescope catalog not already having UBV photometry, using telescopes and photometric equipment at Kitt Peak National Observatory (Davis) and at Cerro Tololo Inter-American Observatory (Deutschman and Schild). Determine variations in the interstellar extinction as a function of distance and galactic longitude and latitude for all stars in the Celescope catalog.

PROGRESS: Observations, data reduction, and preliminary data analysis are complete. We are preparing a paper for publication, most probably in the Astrophysical Journal Supplement Series.

SUPPORTED BY Smithsonian Institution, Astrophysical
Observatory

10.0018, ACQUISITION OF EQUIPMENT FOR HELIUM LIQUEFIER AND RECOVERY SYSTEM

A.M. Goldman, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Dept. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DMR7810902)

A helium liquefier and gas recovery system will be purchased and installed to provide liquid helium for the scientific community at the University of Minnesota as well as for an off-campus institute, the Freshwater Biological Institute. Research requiring the use of liquid helium is carried out in a number of departments of the Institute of Technology and of the College of Biological Sciences. The most active areas of research are condensed matter physics, biochemistry, infrared astronomy, upper atmospheric physics and geomagnetism. Gas recovery will be expanded to include all participating laboratories.

SUPPORTED BY U.S. National Science Foundation, Div. of
Materials Research

10.0019, EQUIPMENT ACQUISITION - FRAPAS

J.A. Lockwood, University System of New Hampshire, University of New Hampshire, School of Liberal Arts, Dept. of Physics, *Durham, New Hampshire* 03824 (ATM79-10543)

This grant will permit the acquisition of a Flight Readiness and Preliminary Analysis Support System (FRAPAS) for the neutron and gamma-ray balloon program at the University of New Hampshire. This system, consisting of such elements as a dual floppy disk, static and dynamic RAMS, terminals, tape transport, and a DEC writer, will enable diagnostic tests to be made on the balloon flight system. Complete system checks and calibrations can be made quickly. Real-time displays of all data can also be made.

A flexible ground support system is needed for the UNH neutron and gamma-ray detector systems because of the extreme complexity of the data acquired. The cosmic-ray isotope and electron measurements of Webber will also use this system. A frame of 18-4 bit words must be processed, two-dimensional matrices analyzed, and extensive checks made to ensure that the system is operating properly. The system will be used primarily with the UNH time-of-flight neutron and gamma-ray detector capable of measuring the fluxes, energy spectra, and angular distributions of neutrons and gamma-rays in the energy intervals from 2 MeV to 60 MeV and 0.5 MeV to 10 MeV respectively. The proposed balloon flights with this detector and the FRAPAS system will attempt to set limits on the diffuse cosmic gamma-ray flux from 0.5 MeV to 3 MeV, and determine the angular distributions and energy spectra of atmospheric neutrons from 3-60 MeV.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0020, CURRICULUM DEVELOPMENT IN ASTRONOMICAL TECHNIQUES

S.L. Sharpless, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (SER7900764)

A course in astronomical techniques is to be developed and implemented in the Department of Physics and Astronomy at the University of Rochester. The course will be designed to improve the capability of the Department and strengthen its offerings at both the undergraduate and graduate levels. The specific objects are two-fold: 1) to provide astronomy majors with a broader base from which to proceed into individual research projects, and 2) to improve the science training of pre-service teachers of science and mathematics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div.
of Science Education Resources
Improvement

10.0021, PHYSICAL NATURE OF COMETS

A.H. Delsemme, University of Toledo, School of Arts & Sciences, Dept. of Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST79-14789)

The program of establishing brightness profiles in the monochromatic light of different molecular, ionic and atomic emissions in comets will be continued. In particular, numerous brightness profiles will be established for Comet West, as a function of its heliocentric distance, from a sequence of spectrograms previously obtained in Toledo. The brightness profiles will be measured in two directions, sunwards and antisunwards. The program will be further developed from spectrograms, obtained either from ground-based observatories (in Toledo or elsewhere) for the major ions (like H, O or CO) and radicals (like CN or C) or to be obtained from space with the international Ultraviolet Explorer, (mainly for H, C and O) should a bright comet appear. This approach has provided the only direct observation known so far for the plasma behavior ahead of a comet, and will yield, therefore, a better understanding of its interaction with the solar wind. It will also coniderably diminish one of the major uncertainties in the measure of the vaporization rate of different gases from the cometary nucleus, and will be therefore an important step towards understanding their mysterious chemisty. Theoretical studies linking hypotheses of cometary origin to their chemical and physical nature will also be undertaken.

Prior support was by NSF grant AST 76-07116A01.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0022, A LONG-RANGE NEUTRINO DETECTOR

K. Lande, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (AST79-08670)

This project will involve support of an experiment for the detection of neutrino and antineutrino bursts emitted by a star as it becomes a supernova. The creation of the supernova involves very large amounts of energy which must be radiated away from the star and much of this energy can be carried by neutrinos. The detection of neutrinos from a supernova explosion will enable one to determine the physical conditions near the center of the star at the onset of the explosion.

The detector will also be able to detect high energy neutrinos from localized stellar sources. One will be able to determine if neutrino oscillations occur for neutrino transits of the earth. The detector will also measure the characteristics of very high energy muons produced by the interaction of cosmic ray primaries in the upper atmosphere. Limits on the lifetime of nucleons such as the proton will also be determined.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0023, THE ALLEGHENY OBSERVATORY TRIGONOMETRIC PARALLAX PROGRAM

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (AST75-02641 A03)

Precision measurement of the parallactic shift for the nearby stars as the earth circles about the sun furnishes the important result of the star's distance and hence its true brightness. Continuation of such measures also reveals the star's motion through space. In addition, for binary stars the stellar masses are determined in favorable cases. These parameters are important results for the physics of the stars.

The Pittsburgh group will continue parallax observations for stars of general interest, brighter than magnitude 16 and north of -20 degrees declination, thought to be within 65 light years of the sun, also some stars of greater distance but of special interest, including those of the Hyades cluster, in an international campaign. In addition, a number of visual and astrometric binaries will be continued under long-term observation. The many requests expected from other astronomers will be processed as rapidly as possible. Further study of ways of improving the precision of observation and reduction will be emphasized. Observations will be made with the Thaw refractor at Pittsburgh and with the 88-inch reflector at high altitude at the Mauna Kea Observatory of the University of Hawaii.

Prior support was by NSF grant AST 75-02641 A01.

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of Astronomical Sciences

10.0024, THE OBSERVATION AND ANALYSIS OF RESULTS FROM THE 16 FEBRUARY 1980 TOTAL SOLAR ECLIPSE - INITIAL PHASE

J.L. Streete, Southwestern at Memphis, Undergraduate School, Dept. of Physcis, *2000 North Pkwy., Memphis, Tennessee* 38112 (ATM79-16235)

Southwestern at Memphis and the High Altitude Observatory (HAO) of the National Center for Atmospheric Research will jointly carry out observations and analysis of the brightness and polarization of the solar corona for the total solar eclipse of 16 February 1980. The results obtained from this program are directed toward a number of specific goals, in addition to their contribution to synoptic studies of the corona: (a) the verification of the in-flight radiance and polarization calibration of the HAO Coronagraph/Polarimeter on the Solar Maximum Mission (SMM); (b) the determination, with high reliability, of the optical parameters of that orbiting instrument; (c) the cross calibration between the SMM instrument and the ground-based HAO Mark III K-Coronameter instrument at Mauna Loa, Hawaii; and (d) the cross calibration with the joint Harvard/HAO Lyman-alpha/White Light Coronagraph Rocket Flight, and other Lyman-alpha rocket coronal observations to be carried out during or near the period of totality.

The main scientific objective is to further our understanding of coronal properties.

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Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0025, JOINT U.S.-FRANCE PROGRAM OF INTERSTELLAR MOLECULAR SPECTROSCOPY

P.A. Vanden Bout, University of Texas, Austin Campus, Graduate School, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (INT78-21382)

This award provides for the support of research in the field of galactic radio astronomy. The objective of the joint research is to make spectral line observations of star-forming interstellar molecular clouds. These observations are aimed at elucidating the conditions which led to star formation.

The two groups will study the physical properties of galactic molecular clouds. The research will center on the determination of the physical conditions in clouds where star formation has occurred or is occurring now, i.e., the densities, temperatures and velocities of the gas and dust, what factors have triggered the onset of star formation and what is the energy balance. To accomplish that goal radio and infra-red data at several wavelengths will be collected. The mm wavelength radio data will be taken on the Texas antenna. The other radio and infra-red data will be obtained at a combination of U.S., French and other European observatories. In addition, the French will provide the U.S. group with a Carcinotron (alternative local oscillator capable of multiplication to higher frequencies i.e., greater than 150 GHz. This device will be installed at the Texas antenna.

This project is under the auspices of the U.S.-France Cooperative Science Program and provides for cooperation between scientists at the University of Texas at Austin and the Meudon Observatory at Paris, France as will as other groups in German, Holland and the U.K.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological
& Internat. Affairs, Div. of International
Programs

10.0026, ANALYSIS OF DIFFERENCES BETWEEN THE OBSERVED AND THEORETICAL POSITIONS OF MARS

R.L. Duncombe, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712

Transit Circle and Astrolabe observations of Mars at all oppositions from 1950 to 1975 show departures in declination from an ephemeris based on the theory of G.M. Clemence. Analysis has shown that the discrepancy arises from an error in the secular change of the inclination of the orbit of Mars. A new geocentric ephemeris incorporating this correction is being prepared.

SUPPORTED BY University of Texas

10.0027, THE EVOLUTION OF STARS IN METAL DEFICIENT SYSTEMS AND RELATED PROBLEMS IN OTHER STARS

R.T. Rood, University of Virginia, School of Arts & Sciences, Dept. of Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (AST76-23170 A01)

This research will involve studies of the structure of stars in galactic globular clusters and dwarf spheroidal galaxies. There will be an analysis of the effect of abundance anomalies on the stars of galactic globular clusters and dwarf spheroidal galaxies which are extremely deficient in their heavy element abundances. An attempt will be made to find improved ways of connecting theoretical calculations and observational data in these systems.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0028, NOBLE GAS GEOCHRONOLOGY OF METEORITES

F.A. Podosek, Washington State University, School of Arts & Sciences, Dept. of Earth & Planetary Sciences, *Administration Bldg., Room 101, Pullman, Washington* 99163 (EAR7823853)

This project is focused on study of the chronology of the earth solar system, based on the natural radionuclides 129I, 244Pu and 40K. The experimental work principally involves noble gas mass spectrometric analyses of selected meteorites, but other techniques also play important roles. The chronological information is contained in the relationships between the parent radionuclides and their noble gas decay products (129Xe, fission Xe, 40Ar).

In addition to a study of the chronology of events in the early solar system, this program is also an investigation of more general aspects of solar system isotopic structures and the apparent lack of complete homogenization of the various nucleosynthetic products of which the solar system is made. This results from determination of the isotopic composition of xenon in the material from which meteorites formed and from establishing limits to the possibly heterogeneous distribution of short-lived radionuclides. For the latter the simultaneous study of 129I, 244Pu and absolute chronology by 40Ar-39Ar analysis is an important feature of the proposed program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

GENERAL

11.0001, SUMMER RESEARCH FELLOWSHIP PROGRAM

G.C. Darden, Hampton Inst., Graduate School, Dept. of Mathematics, *Hampton, Virginia* 23368 (NAS 1-14832)

The main purpose of the Summer Research Fellowship Program is to involve more predominantly black colleges and universities in activities of the National Aeronautics and Space Administration in a way that will strengthen and expand the academic programs of these institutions.

OBJECTIVES OF THE PROGRAM: 1. To promote cooperative ventures between these institutions and the Langley Research Center; 2. To increase the resource base available to the Langley Research Center for application to its research mission; 3. To expand the academic program at participating institutions.

PARTICIPANTS: The program provides ten persons the opportunity to engage in research at the Langley Research Center for ten weeks during the summer. Participants are required to write a report on their respective projects which are chosen from a list developed by the divisions of the Center. Each participant works with a Center scientist during the summer and has full access to equipment necessary to complete the project.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

11.0002, NASA-MORGAN STATE UNIVERSITY SUMMER FACULTY RESEARCH PROGRAM

N.K. Proctor, Morgan State University, Graduate School, Dept. of Biology, *Hillen Rd. & Cold Spring Ln., Baltimore, Maryland* 21212 (NGT 21-025-006)

The purpose of the Summer Faculty Research program is to (1) benefit the academic process at participating institutions; (2) further cooperation between participating institutions and Goddard Space Flight Center; and (3) increase the resources available to Goddard for application to its research mission. Selected faculty engage in research at Goddard Space Flight Center during a 10-week period and work under the supervision of technical monitors from Goddard. Problems investigated by faculty are in the areas of mathematics, computer science, physics, chemistry, management systems, and engineering. Goddard provides specific problems in the above areas and participants are selected based on prior education and experience.

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-17981*# Battelle Columbus Labs., Ohio.
USER DEFINITION AND MISSION REQUIREMENTS FOR UNMANNED AIRBORNE PLATFORMS, REVISED Final Report
M. B. Kuhner and J. R. McDowell Dec. 1979 87 p Revised
(Contract NAS6-2938)
(NASA-CR-156861) Avail: NTIS HC A05/MF A01 CSCL 02A

The airborne measurement requirements of the scientific and applications experiment user community were assessed with respect to the suitability of proposed strawman airborne platforms. These platforms provide a spectrum of measurement capabilities supporting associated mission tradeoffs such as payload weight, operating altitude, range, duration, flight profile control, deployment flexibility, quick response, and recoverability. The results of the survey are used to examine whether the development of platforms is warranted and to determine platform system requirements as well as research and technology needs. J.M.S.

N80-17982# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A CONSIDERATION OF GENERAL AVIATION IN THE UNITED KINGDOM
R. E. Caves May 1979 73 p refs
(TT-7902; ISSN-0140-9751) Avail: NTIS HC A04/MF A01

A semistructural analysis of the operational and economic viability on 1978 data, is presented. Models of contemporary fare structures, block times, and costs are developed in order to determine break even values for third level scheduled operations. Two potentially attractive routes from a theoretical stand point are examined to demonstrate the marginal nature of third level operations. Some attention is given to airport access, to nonscheduled general aviation, and to the relevance of the results within present U.K. transport planning choices. Author (ESA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N80-17983 *Illinois Inst. of Tech., Chicago.*
DYNAMIC STALL ON OSCILLATING AIRFOILS IN OSCILLATING FREE-STREAMS Ph.D. Thesis
Bang-Ji Hsieh 1979 278 p
Avail: Univ. Microfilms Order No. 8003648

The dynamic stall phenomenon on an oscillating airfoil in the presence of the free stream oscillations was studied. The study was conducted on a NACA 0012 profile airfoil which was oscillating in pitch around a mean angle of attack of 15 degrees with an amplitude of 10 degrees. The corresponding range of angles extending from 5 to 25 degrees includes the angle of stall of a stationary airfoil in steady flow which was about 12 degrees under present conditions. Tests were made in both steady and oscillating free streams and at the two reduced frequencies of 0.15 and 0.25. Education, i.e., periodic sampling and averaging was used to remove the nonphase related noise from the pressure signals providing an instantaneous ensemble average which was phase related to the oscillation of the airfoil, of the free stream, or both. The instantaneous distributions of pressure coefficient, normal force coefficient and moment coefficient were computed from the instantaneous educted pressure signals in terms of the instantaneous dynamic pressure of the free stream. Comparisons between tripped and untripped flows and between the flows at the two reduced frequencies are discussed. Dissert. Abstr.

N80-17984*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF TWO LARGE ANNULAR DIFFUSERS WITH SWIRLING AND DISTORTED INFLOW
William T. Eckert, James P. Johnston (Stanford Univ., Calif.), Tad D. Simons (Stanford Univ., Calif.), Kenneth W. Mort, and V. Robert Page Feb. 1980 106 p refs
(NASA-TP-1628; AVRADCOM-TR-79-40; A-7436) Avail: NTIS HC A06/MF A01 CSCL 01A

Two annular diffusers downstream of a nacelle-mounted fan were tested for aerodynamic performance, measured in terms of two static pressure recovery parameters (one near the diffuser exit plane and one about three diameters downstream in the settling duct) in the presence of several inflow conditions. The two diffusers each had an inlet diameter of 1.84 m, an area ratio of 2.3, and an equivalent cone angle of 11.5, but were distinguished by centerbodies of different lengths. The dependence of diffuser performance on various combinations of swirling, radially distorted, and/or azimuthally distorted inflow was examined. Swirling flow and distortions in the axial velocity profile in the annulus upstream of the diffuser inlet were caused by the intrinsic flow patterns downstream of a fan in a duct and by artificial intensification of the distortions. Azimuthal distortions or defects were generated by the addition of four artificial devices (screens and fences). Pressure recovery data indicated beneficial effects of both *radial* distortion (for a limited range of distortion levels) and inflow swirl. Small amounts of azimuthal distortion created by the artificial devices produced only small effects on diffuser performance. A large artificial distortion device was required to produce enough azimuthal flow distortion to significantly degrade the diffuser static pressure recovery. Author

N80-17985# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.
RESEARCH ON THE STABILITY OF AIR CUSHION SYSTEMS
P. A. Sullivan, M. Hinchey, I. Murra, and G. J. Parravano Nov. 1979 166 p refs
(UTIAS-238; ISSN-0082-5255) Avail: NTIS

HC A08/MF A01

Certain specified problems encountered in the development of flexible multicell type skirted air cushions for overland use are described. The hysteresis mechanisms in static roll stiffness are included. A preliminary examination of the dynamics of a skirt developed for low speed operation is reported and the progress made on the analysis and prediction of self excited oscillations in heave is summarized. R.C.T.

N80-17986*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

WIND-TUNNEL/FLIGHT CORRELATION STUDY OF AERODYNAMIC CHARACTERISTICS OF A LARGE FLEXIBLE SUPERSONIC CRUISE AIRPLANE (XB-70-1). 3: A COMPARISON BETWEEN CHARACTERISTICS PREDICTED FROM WIND-TUNNEL MEASUREMENTS AND THOSE MEASURED IN FLIGHT

Henry H. Arnaiz, John B. Peterson, Jr. (NASA. Langley Research Center), and James C. Daugherty (NASA. Ames Research Center) Mar. 1980 59 p refs
(NASA-TP-1516; H-1079) Avail: NTIS HC A04/MF A01 CSCL 01A

A program was undertaken by NASA to evaluate the accuracy of a method for predicting the aerodynamic characteristics of large supersonic cruise airplanes. This program compared predicted and flight-measured lift, drag, angle of attack, and control surface deflection for the XB-70-1 airplane for 14 flight conditions with a Mach number range from 0.76 to 2.56. The predictions were derived from the wind-tunnel test data of a 0.03-scale model of the XB-70-1 airplane fabricated to represent the aeroelastically deformed shape at a 2.5 Mach number cruise condition. Corrections for shape variations at the other Mach numbers were included in the prediction. For most cases, differences between predicted and measured values were within the accuracy of the comparison. However, there were significant differences at transonic Mach numbers. At a Mach number of 1.06 differences were as large as 27 percent in the drag coefficients and 20 deg in the elevator deflections. A brief analysis indicated that a significant part of the difference between drag coefficients was due to the incorrect prediction of the control surface deflection required to trim the airplane. Author

N80-17987*# National Aeronautics and Space Administration. Washington, D. C.

BOUNDARY LAYER CONTROL BY MEANS OF SUCTION

G. Maillart Jan. 1980 45 p refs Transl. into ENGLISH from Bull. des Services Techniques 106, Apr. 1947 35 p Original language document was announced as N79-71086 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75502) Avail: NTIS HC A03/MF A01 CSCL 01A

The process of boundary layer control by means of suction is described. Its historical development is briefly traced, and its application to airfoils and diffusers is discussed. Author

N80-17988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

INTERACTION OF A TWO-DIMENSIONAL STRIP BOUNDARY LAYER WITH A THREE-DIMENSIONAL TRANSONIC SWEPT-WING CODE

Perry A. Newman, James E. Carter, and Ruby M. Davis Mar. 1978 35 p refs
(NASA-TM-78640) Avail: NTIS HC A03/MF A01 CSCL 01A

A 3D inviscid transonic analysis code was combined with a 2D strip integral boundary layer technique to form an approximate interaction procedure for analyzing the flow over a high aspect ratio wing near cruise conditions. Converged results obtained using the procedure for an aspect ratio 10.3 supercritical wing are discussed. Angle of attack adjustments were made during the iterative procedure in order to compensate for the viscous lift loss. A comparison of the calculations with experimental data is presented. A.W.H.

N80-17989*# Lockheed-Georgia Co., Marietta.

THE AERODYNAMIC DESIGN OF AN ADVANCED ROTOR AIRFOIL

James A. Blackwell, Jr. and Bobby L. Hinson Mar. 1978 112 p
(Contract NAS1-14597)
(NASA-CR-2961; LG77ER0206) Avail: NTIS HC A06/MF A01 CSCL 01A

An advanced rotor airfoil, designed utilizing supercritical airfoil technology and advanced design and analysis methodology is described. The airfoil was designed subject to stringent aerodynamic design criteria for improving the performance over the entire rotor operating regime. The design criteria are discussed. The design was accomplished using a physical plane, viscous, transonic inverse design procedure, and a constrained function minimization technique for optimizing the airfoil leading edge shape. The aerodynamic performance objectives of the airfoil are discussed. A.W.H.

N80-17990*# National Aeronautics and Space Administration, Washington, D. C.

SOLUTION OF A FEW NONLINEAR PROBLEMS IN AERODYNAMICS BY THE FINITE ELEMENTS AND FUNCTIONAL LEAST SQUARES METHODS *Ph.D. Thesis - Paris Univ.*

Jacques Periaux Dec. 1979 278 p refs Transl. into ENGLISH of "Resolution de quelques Problems non Lineaires en Aerodynamique par des Methodes d'Elements Finis et de Moindres Carres Fonctionnels" Paris, 19 Jun. 1979 280 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75732) Avail: NTIS HC A13/MF A01 CSCL 01A

The numerical simulation of the transonic flows of idealized fluids and of incompressible viscous fluids, by the nonlinear least squares methods is presented. The nonlinear equations, the boundary conditions, and the various constraints controlling the two types of flow are described. The standard iterative methods for solving a quasi elliptical nonlinear equation with partial derivatives are reviewed with emphasis placed on two examples: the fixed point method applied to the Gelder functional in the case of compressible subsonic flows and the Newton method used in the technique of decomposition of the lifting potential. The new abstract least squares method is discussed. It consists of substituting the nonlinear equation by a problem of minimization in a H to the minus 1 type Sobolev functional space. A.W.H.

N80-17991*# National Aeronautics and Space Administration, Washington, D. C.

COMPARISON OF AERODYNAMIC COEFFICIENTS OBTAINED FROM THEORETICAL CALCULATIONS WIND TUNNEL TESTS AND FLIGHT TESTS DATA REDUCTION FOR THE ALPHA JET AIRCRAFT

R. Guiot and H. Wunnenberg Feb. 1980 31 p refs Transl. into ENGLISH of "Comparison des Coefficients Aerodynamiques Issues des Calculs Theoretiques, Essais en Soufflerie et Depouillements d'Essais en vol Effectues sur l'Alpha Jet", Rept. AGARD-CP-187 AGARD Presented at the 46th Meeting of the Flight Mech. Panel, Valloire, France, 9-13 Jun. 1975 p 19-1 - 19-15 Original language document was announced as N76-25295 Transl. by Kanner (Leo) Associates Redwood City, Calif. Original language document prepared by Avions Marcel Dassault-Breguet Aviation, Saint-Cloud, France and Dornier-Werke G.m.b.H., Friedrichshafen, West Germany
(Contract NASw-3199)
(NASA-TM-75237; AGARD-CP-187) Avail: NTIS HC A03/MF A01 CSCL 01A

The methods by which aerodynamic coefficients are determined and discussed. These include: calculations, wind tunnel experiments and experiments in flight for various prototypes of the Alpha Jet. A comparison of obtained results shows good correlation between expectations and in-flight test results. J.M.S.

N80-17992*# Mississippi State Univ., State College. Dept. of Aerospace Engineering.

FULL SCALE VISUALIZATION OF THE WING TIP VORTICES GENERATED BY A TYPICAL AGRICULTURAL AIRCRAFT Final Report

Ernest J. Cross, Jr., Phillip D. Bridges, Joe A. Brownlee, W. Wayne Livingston et al Jan. 1980 102 p refs
(Contract NsG-1511)

(NASA-CR-162796; MSSU-EIRS-ASE-80-2) Avail: NTIS HC A06/MF A01 CSCL 01A

The trajectories of the wing tip vortices of a typical agricultural aircraft were experimentally determined by flight test. A flow visualization method, similar to the vapor screen method used in wind tunnels, was used to obtain trajectory data for a range of flight speeds, airplane configurations, and wing loadings. Detailed measurements of the spanwise surface pressure distribution were made for all test points. Further, a powered 1/8 scale model of the aircraft was designed, built, and used to obtain tip vortex trajectory data under conditions similar to that of the full scale test. The effects of light wind on the vortices were demonstrated, and the interaction of the flap vortex and the tip vortex was clearly shown in photographs and plotted trajectory data. Author

N80-17993*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECT OF SWEEP AND ASPECT RATIO ON THE LONGITUDINAL AERODYNAMICS OF A SPANLOADER WING IN- AND OUT-OF-GROUND EFFECT

Scott O. Kjelgaard and John W. Paulson, Jr. Jan. 1980 166 p refs
(NASA-TM-80199) Avail: NTIS HC A08/MF A01 CSCL 01A

A wind tunnel investigation was conducted to determine the effects of leading edge sweep, aspect ratio, flap deflection, and eleven deflection on the longitudinal aerodynamic characteristics of a span distributed load advanced cargo aircraft (spanloader). Model configurations consisted of leading edge sweeps of 0, 15, 30, and 45 deg and aspect ratios of approximately 2, 4, 6, and 8. Data were obtained for angles of attack of -8 to 18 deg out of ground effect and at angles of attack of -2, 0, and 2 deg in ground effect at Mach number equal 0.14. Flap and elevon deflections ranged from -20 to 20 deg. The data presented in tabulated form are intended for reference purposes and are presented without analysis. A.W.H.

N80-17994*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.

COMPUTER PREDICTION OF THREE-DIMENSIONAL POTENTIAL FLOW FIELDS IN WHICH AIRCRAFT PROPELLERS OPERATE: COMPUTER PROGRAM DESCRIPTION AND USERS MANUAL

Stephen J. Jumper Aug. 1979 258 p refs
(Grant NsG-1308)
(NASA-CR-162816; PSU-Aero-R-79/80-5) Avail: NTIS HC A12/MF A01 CSCL 01A

A method was developed for predicting the potential flow velocity field at the plane of a propeller operating under the influence of a wing-fuselage-cowl or nacelle combination. A computer program was written which predicts the three dimensional potential flow field. The contents of the program, its input data, and its output results are described. R.E.S.

N80-17995*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

A CALCULATION PROCEDURE FOR VISCOUS FLOW IN TURBOMACHINES, VOLUME 2

J. Khalil and W. Tabakoff Jan. 1980 54 p refs
(Contract NAS3-21609; DA Proj. 1L1-61102-AH-45)
(NASA-CR-159636) Avail: NTIS HC A04/MF A01 CSCL 21E

Turbulent flow within turbomachines having arbitrary blade geometries is examined. Effects of turbulence are modeled using two equations, one expressing the development of the turbulence kinetic energy and the other its dissipation rate. To account for complicated blade geometries, the flow equations are formulated in terms of a nonorthogonal boundary fitted coordinate system. The analysis is applied to a radial inflow turbine. The solution obtained indicates the severity of the complex interaction mechanism that occurs between the different flow regimes (i.e., boundary layers, recirculating eddies, separation zones, etc.). Comparison with nonviscous flow solutions tend to justify strongly the inadequacy of using the latter with standard boundary layer techniques to obtain viscous flow details within turbomachine rotors. Capabilities and limitations of the present method of analysis are discussed. M.G.

N80-17996# Naval Surface Weapons Center, White Oak, Md.

AN EXPERIMENTAL STUDY OF TWO-DIMENSIONAL SUPERSONIC JET IMPINGEMENT ON A FLAT PLATE

T. F. Zien and R. T. Driftmyer Aug. 1979 95 p refs
(AD-A076536; NSWC/TR-79-289) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental study of the flow field associated with a two-dimensional, supersonic jet impinging normally on a flat plate is reported. Two wedge nozzles manufactured at the design Mach numbers of 1.75 and 2.75, respectively, were used to provide the jet. Extensive pitot surveys of the free jet were first conducted to determine the quality of the free jet. Results indicate that the simple wedge nozzles were adequate in providing the desired two-dimensional jet in the free expansion configuration. Results of surface pressure measurements and schlieren photographs of the impingement flow indicating the shock patterns are then presented and discussed. Although the results are principally reported for the case of the jet at isentropic exit conditions, some results of underexpanded and overexpanded jets are also included. Some discrepancies between the experiment and the simple theory based in the method of integral relations and the inviscid flow model are noted and discussed. An 'effective' jet Mach number is introduced which accounts largely for the discrepancy between experiments and theory, and its determination is based on the measured stagnation point pressure on the plate surface. GRA

N80-17997# Aeronautical Research Labs., Melbourne (Australia).

THE AERODYNAMICS DIVISION AIRBORNE DATA ACQUISITION PACKAGE TEST AND CALIBRATION

P. Ferrarotto Mar. 1979 37 p refs
(AD-A071365; ARL/Aero-TM-312) Avail: NTIS HC A03/MF A01 CSCL 14/2

The unit described in this memorandum was designed and built in conjunction with the Aerodynamics Division Airborne Data Acquisition Package (ADADAP). It provides a means by which the ADADAP can be checked for correct operation. The output signals of the unit simulate the various analogue signals which would normally be derived from transducers on board an instrumented aircraft. A brief description of the operation of the unit and circuit details are included in this memorandum. GRA

N80-17998# Dayton Univ. Research Inst., Ohio.

NUMERICAL SOLUTION OF A SUPERSONIC NOZZLE AFTERBODY FLOW WITH JET EXHAUST Final Report, Sep. 1976 - Feb. 1978

Ameer G. Mikhail Jun. 1979 69 p refs
(Contract F33615-76-C-3145; AF Proj. 2307)
(AD-A076116; UDR-TR-79-43; AFFDL-TR-79-3078) Avail: NTIS HC A04/MF A01 CSCL 20/4

Numerical solutions to the compressible turbulent Navier-Stokes equations for supersonic flow at Mach number 1.5, past an axisymmetric nozzle boattail with jet exhaust were obtained using MacCormack's explicit numerical scheme. The AGARD 10 deg-nozzle was considered and a total of five cases were computed showing the effects of boattail geometry, jet-exhaust temperature, boattail wall temperature and the differences with the corresponding two-dimensional case. It was established that the hot boattail surface reduces the pressure drag significantly as does the hot jet exhaust when compared with the cold wall, cold exhaust case. The present approach can be used directly for boattailing nozzles for minimum pressure drag, as well as for a parametric study for aircraft designers. GRA

N80-17999# Weapons Systems Research Lab., Adelaide (Australia).

CALCULATION OF SUBSONIC NORMAL FORCE AND CENTRE OF PRESSURE POSITION OF BODIES OF REVOLUTION USING SLENDER BODY THEORY BOUNDARY LAYER METHOD

K. D. Thomson Apr. 1979 37 p refs
(AD-A076128; WSRL-0093-TR; AR-001-656) Avail: NTIS HC A03/MF A01 CSCL 20/4

The aim of this report is to present a method of predicting the aerodynamic characteristics of slender bodies of revolution at small incidence, under flow conditions such that the boundary layer is turbulent. Firstly, a panel method based on slender body theory is developed and used to calculate the surface velocity distribution on the body at zero incidence. Secondly, this velocity distribution is used in conjunction with an existing boundary layer estimation method to calculate the growth of boundary layer displacement thickness which is added to the body to produce the effective aerodynamic profile. Finally, recourse is again made to slender body theory to calculate the normal force curve slope and center of pressure position of the effective aerodynamic profile. Comparisons made between predictions and experiment for a number of slender bodies extending from highly boattailed configurations to ogive-cylinders, and covering a large range of boundary layer growth rates, indicate that the method is useful for missile design purposes. GRA

N80-18000# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.

THEORETICAL ANALYSIS OF THE FLOW FIELD OVER A FAMILY OF OGIVE BODIES, VOLUME 2

R. L. Richardson and B. Z. Jenkins 20 Aug. 1979 56 p refs
(AD-A077397; DRSMI-T-CR-77-5) Avail: NTIS HC A04/MF A01 CSCL 20/4

Local normal force distributions are presented for pointed tangent ogive bodies and spherically blunted tangent ogive bodies at free stream Mach numbers of 2 to 4.5 at 2 deg angle-of-attack. Also, total or integrated values of normal force coefficients, pitching moment coefficients, and centers of pressure are given for all body shapes as a function of free stream Mach number for the same angle of attack. These data were obtained using the US Army Missile Command three-dimensional method of characteristics computer code. GRA

N80-18001# Neilsen Engineering and Research, Inc., Mountain View, Calif.

DATA REPORT FOR A TEST PROGRAM TO STUDY TRANSONIC FLOW FIELDS ABOUT WING-BODY/PYLON/STORE COMBINATIONS. VOLUME 1: TUNNEL EMPTY FLOW SURVEY DATA, WING BODY FORCE/MOMENT/SURFACE PRESSURE DATA, AND PRESSURE STORE FORCE/MOMENT/SURFACE PRESSURE DATA Interim Summary Report, 14-22 Feb. 1978

S. S. Stahara and A. J. Crisalli May 1978 256 p
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A077182; AFOSR-79-1070TR; NEAR-TR-163-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 20/4

Results are presented for transonic wind tunnel tests conducted in the 4T Wind Tunnel at Arnold Engineering and Development Center for various wing-body/pylon store model combinations. Experimental data were obtained at 0.2, and 5 degrees angle of attack of the model combinations and at Mach numbers of 0.925, 0.950, 1.05, and 1.10 in the transonic range. Pylon and store models were attached to a wing-body combination in two separate, systematic model build-up sequences. At each stage of the first sequence, flow velocities and static pressures were obtained in the vicinity of the store or those regions normally occupied by a store while force, moment, and surface pressure measurements were taken on the wing-body model. Also, flow velocities and static pressure were recorded on a cylindrical control surface far from the tunnel centerline to provide outer flow field conditions. The second model build-up sequence involved a special pressure-instrumented store that was mounted on the captive trajectory system for simulating a separating store. Detailed pressure distributions and loading were obtained on the store. GRA

N80-18002# Neilsen Engineering and Research, Inc., Mountain View, Calif.

DATA REPORT FOR A TEST PROGRAM TO STUDY TRANSONIC FLOW FIELDS ABOUT WING-BODY/PYLON/STORE COMBINATIONS. VOLUME 2: FLOW FIELD SURVEY DATA FOR CONFIGURATIONS 21 AND 22 Interim Report, 14-23 Feb. 1978

S. S. Stahara and A. J. Crisalli May 1978 247 p
(Contract F44620-75-C-0047; AF Proj. 2307)
(AD-A077183; AFOSR-79-1071TR; NEAR-TR-163-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 20/4

This volume of the data report presentes the flow-field survey data for configurations 21 and 22 at Mach numbers M1 = 0.925, M2 - 0.950, and M3 = 1.05 and angles of attack alpha = 0, 2, and 5 degrees. The data were obtained in the 4T Wind Tunnel at Arnold Engineering and Development Center. These tests, performed at a nominal Reynolds number per foot of 3.0 x 10 to the 6th power are indexed and outlined. GRA

N80-18003# Institut de Mecanique des Fluides de Marseille (France).

TRANSIENT EFFECTS ON A STALLED AIRFOIL IN A PULSATING FLOW: COMPARISON WITH RESULTS FROM A SIMILAR AIRFOIL UNDERGOING HORIZONTAL SHAKING [EFFETS INSTATIONNAIRES SUR UN PROFIL EN DECROCHAGE DANS UN ECOULEMENT PULSE; COMPARISON AVEC LE MOUVEMENT DE TAMIS]

C. Maresca, D. Favier, and J. Rebont Paris Assoc. Aeron. et Astronautique de Paris 1979 66 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(Contract STTA-77/98/313/00/481/75/86)
(AAAF-NT-79-13; ISBN-2-7170-0540-4) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The unsteady effects encountered by a symmetrical airfoil NACA 0012 set at fixed indicence (20 deg) in an oscillating flow (delta V/V = 0.74; C sub omega/2V = 0.65; Re = 70,000) were studied. The results were obtained through measurements of aerodynamic components (lift, drag, moment) evidenced by distributions of the static pressure and skin friction along the chord of the airfoil and through visualizations around the airfoil at different phases of the period. The results are discussed and compared with those already obtained on the same airfoil moving forward-backwards in a uniform flow under the same conditions. As far as the mean effects on the lift, drag, pressure distribution, and vortex shedding mechanism on the upper side of the airfoil are concerned, the reciprocity of the two kinds of flow is demonstrated. Author (ESA)

N80-18004# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Aerothermodynamique.

IMPLEMENTATION OF UNSTEADY OSCILLATORY FLOW IN A TRANSONIC WIND TUNNEL [MISE AU POINT D'ECOULEMENTS INSTATIONNAIRES OSCILLATOIRES DANS UNE SOUFFLERIE TRANSSONIQUE]

A. Mignosi, J. L. Gobert, and C. Quemard Paris Assoc. Aeron. et Astronautique de France 1979 42 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-15; ISBN-2-7170-0542-0) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

Oscillatory flow was obtained in an injector driven transonic wind tunnel through periodic variation of the downstream throat area by rotation of a suitable shaped cam. The measurement techniques and the probes developed for the experimental studies are described. The characteristics of the unsteady flow in the test section are compared with the results from computations based on the resolution of the unsteady equations. One dimensional flow is assumed. The possibilities of such a device are illustrated by a preliminary study of a wing profile in a transonic flow. The oscillation of both the shock wave and the wake in answer to flow pulsation is shown. Author (ESA)

N80-18005# Office National d'Etudes et de Recherches Aerospatiales, Modane (France).

UNSTEADY FLOW MEASUREMENTS IN AIR INTAKES [MESURES INSTATIONNAIRES DANS UNE PRISE D'AIR]

M. Grandjacques Paris Assoc. Aeron. et Astronautique de France 1979 23 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-16; ISBN-2-7170-0543-9) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The means for studying the steady and unsteady flow of air intakes by measuring the pressures at the compressor inlet plane are described. Improved instantaneous differential pressure measurement devices are described which extend the range of utilization from 40 C to 100 C and compensate the zero and sensitivity thermal offsets. The system was assembled for simultaneous measurement in 40 channels at a rate of up to

1700 pressure measurements per second. The results show that the system is adequate for industrial applications, yielding a precision range on the order of 0.5%. Author (ESA)

N80-18006# Institut de Mecanique des Fluides de Marseille (France).
ON THE PULSATION OF A NORMAL SHOCK WAVE CONTAINED IN AN AERODYNAMIC INLET [PULSATION D'UN CHOC DROIT EN AERODYNAMIQUE INTERNE]
A. Agnes, E. Brocher, and H. Miton Paris Assoc. Aeron. et Astronautique de France 1979 21 p refs In FRENCH; ENGLISH summary Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978 Sponsored by Direc. des Rech. Etudes et Tech. (DRET)
(AAAF-NT-79-17; ISBN-2-7170-0544-7) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The response of a normal shock wave, located in a nozzle to down stream pressure perturbation was determined. The system for generating pulsations is described, which consists basically of a Hartmann Sprenger tube in which oscillations of up to 30 KHz can be produced. Initial results are presented showing the two frequencies at which the shock wave oscillations are particularly intense. The computation method for the shock wave oscillation amplitude is also discussed. Author (ESA)

N80-18007# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
THE GUST AS A COHERENT STRUCTURE IN THE TURBULENT BOUNDARY LAYER
Haakan Gustavsson and Magnus Linde 1979 19 p refs
(Contract SWED-BESD-5061-012)
(FFA-TN-AU-1499-Pt-5) Avail: NTIS HC A02/MF A01

Gusts in the atmospheric boundary layer are coherent structures which seem to have very characteristic features. The same kind of structures were found in turbulent boundary layers investigated in the laboratory. The results of such experiments were used to formulate a model for the gust which emphasizes its deterministic features. As a result, the gust structure is scaled on the outer variables of the boundary layer, i.e., the thickness of the boundary layer and the free stream velocity. The gust's longitudinal extent is considerably larger than its lateral one. Its front has a slope in the wind direction. Within the gust, there is first a decrease in the longitudinal velocity followed by a steep rise and a subsequent slow decay to the mean value. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N80-18008# Lockheed-California Co., Burbank.
GENERAL AVIATION AIRPLANE STRUCTURAL CRASHWORTHINESS PROGRAMMER'S MANUAL Final Report, Nov. 1977 - Dec. 1978
W. L. Labarge Jun. 1979 210 p Revised
(Contract DOT-FA75WA-3707)
(AD-A075737; FAA-RD-78-120-Rev; LR-23683) Avail: NTIS HC A10/MF A01 CSCL 13/12

A programming manual is presented to describe the program KRASH. Included are: systems requirements, input data deck, and demonstration problems. M.M.M.

N80-18009# Federal Aviation Administration, Washington, D. C. Office of Aviation Medicine.
TASK FORCE ON DETERRENCE OF AIR PIRACY Final Report
H. L. Reighard and John T. Dailey Nov. 1978 138 p
(AD-A076457; FAA-AM-78-35) Avail: NTIS HC A07/MF A01 CSCL 01/2

The establishment of a multidisciplinary task force on the deterrence of air piracy and the work of the task force in developing an airline passenger preboarding screening system and other actions to deter hihacking is summarized. The screening system combines a behavioral profile with a metal detecting magnetometer to identify those persons who could be potential hijackers. The value of the epidemiological method is discussed and the multidisciplinary approach to the problems of hijacking is emphasized. A.W.H.

N80-18010*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA AVIATION SAFETY REPORTING SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1978
Jun. 1979 54 p refs Prepared in cooperation with Battelle Columbus Labs., Mountain View, Calif.
(NASA-TM-78608; A-7904; QR-9) Avail: NTIS HC A04/MF A01 CSCL 01C

The human factors frequency considered a cause of or contributor to hazardous events onboard air carriers are examined with emphasis on distractions. Safety reports that have been analyzed, processed, and entered into the aviation safety reporting system data base are discussed. A sampling of alert bulletins and responses to them is also presented. J.M.S.

N80-18011*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE AERIAL RELAY SYSTEM: AN ENERGY-EFFICIENT SOLUTION TO THE AIRPORT CONGESTION PROBLEM
Albert C. Kyser Jan. 1980 24 p refs Presented at the AIAA Aircraft Systems and Technol. Meeting, New York, 22 Aug. 1979
(NASA-TM-80208) Avail: NTIS HC A02/MF A01 CSCL 17B

The ability to transfer airline passengers between aircraft in flight, if adequately developed and integrated into the national air transportation system, could provide significant improvements in transportation-system performance, in terms of airport congestion, fuel consumption, and passenger service. The proposed Aerial Relay System concept, which was developed as a means of exploiting inflight transfer, makes use of large 'cruise liner' aircraft which fly continuously along their routes, docking periodically with short-haul feeder aircraft for exchange of payloads. Preliminary vehicle designs for a representative system are described and the operational feasibility of the concept for the United States in the 1990's is discussed. R.E.S.

N80-18012# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
HUMAN FACTORS IN HIGH SPEED LOW LEVEL ACCIDENTS: A 15 YEAR REVIEW
R. C. Rud and D. F. Leben Jul. 1979 13 p refs
(AD-A076221; DCIEM-79-R35) Avail: NTIS HC A02/MF A01 CSCL 01/2

The Canadian Forces introduced the gf 104G into Squadron Operation in 1963 and since that time these aircraft have operated in the high-speed, low-level environment in both the strike/reconnaissance and tactical support roles. Fifty-seven accidents involving these aircraft are reviewed with regard to cause factors. Marginal weather appears to be the one most significant factor contribution to low-level, high-speed accidents however, several human factors such as visual contrast problems, fatigue, stress, reaction time, 'mission completion' syndrome, inattention and task overload were identified. Aspects of accidents which typify human factors problems are described. Suggested possible preventive measures are outlined. Author (GRA)

N80-18013# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
FEASIBILITY TESTING OF A BODY INFLATABLE BLADDER (BIB) RESTRAINT DEVICE Phase Report
Marcus Schwartz Apr. 1979 46 p
(WF41400000)
(AD-A078681; NADC-79241-60) Avail: NTIS HC A03/MF A01 CSCL 06/17

A feasibility model of an inflatable type restraint system was designed and developed for use with existing operational restraint hardware to improve crewman safety during ejection. The vest type inflatable system is worn over the flight suit and under the MA-2 integrated torso harness. Upon inflation, the crewman is forced back into the suit while slack is removed from the harness. Subsequent ejection tower testing has demonstrated significant reductions in horizontal head and torso response during the catapult phase of the ejection. Author (GRA)

N80-18014# Technische Hogeschool, Delft (Netherlands). Afdel. der Luchtvaart- en Ruimtevaarttechniek.
AVIATION SAFETY AND ITS IMPROVEMENT [DE VEILIGHEID IN DE LUCHTVAART EN HAAR BEWAKING]
H. Wittenberg Jan. 1978 55 p refs In DUTCH Presented at Symp. Veiligheid van de Vervoerssystemen, Delft, 17 Mar. 1978
(VTH-LR-260) Avail: NTIS HC A04/MF A01

A synopsis of 75 years of air transportation data was compiled in relation to aircraft accidents and aviation safety. Regulations covering aircraft construction, maintenance, aircraft control and navigation, training, and accident investigation are reviewed. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N80-18015 Illinois Univ. at Urbana-Champaign.
A NEW APPROACH TO MULTI-SENSOR NAVIGATION SYSTEM DESIGN
Michael Joseph Cannon 1979 126 p
Avail: Univ. Microfilms Order No. 8004147

The flexibility and power of digital processors in the design of aviation navigation systems is discussed. Navigation systems which use a variety of input sensors and which use processors to integrate the system components are examined. Methods for counting errors in specific sensor inputs are examined in terms of the characteristics of the sensors. The set of input sensors, when properly chosen, can complement one another in the information they provide and in their operating domains. Overlap in the information provided makes possible cross checking for sensor errors or equipment failure and allows for a variety of degraded or backup mode operations. These areas in navigation systems and their design are emphasized. Dissert. Abstr.

N80-18016 Texas A&M Univ., College Station.
A NAVIGATION ALGORITHM FOR SINGLE CHANNEL LOW-COST GPS RECEIVER Ph.D. Thesis
Hamed Parsiani 1979 133 p
Avail: Univ. Microfilms Order No. 8003171

A sequential navigation algorithm for a navigator using the Global Positioning System satellites was developed and tested for both noise-free and noisy system models. Data from a six-hour flight from California to Hawaii (C5A aircraft) simulated a true user to test the accuracy of the user's position for a sequential navigation system. Dissert. Abstr.

N80-18017# Federal Aviation Administration, Washington, D. C. Office of Systems Engineering Management.
REPORT ON THE TASK FORCE ON AIRCRAFT SEPARATION ASSURANCE, APPENDICES
D. J. Bryant, D. G. Hamrick, W. D. Love, A. L. McFarland, A. D. Mundra, H. C. Strunz, and C. F. Swett Jan. 1979 334 p ref
(AD-A077713; FAA-EM-78-19-Vol-3-App; AEM-2) Avail: NTIS HC A15/MF A01 CSCL 17/7

An integrated aircraft separation assurance (ASA) system for the national airspace system is examined. The system element requirements which are defined to provide two levels of backup to the ATC system, a separation violation warning and a final fail safe collision advisory and resolution function, are defined. Current ASA development programs are discussed and the changes required to make the transition to an integrated ASA system are reported. This volume includes appendices for two previous volumes and defines in detail the specific interfaces and designs required for system integration. A.W.H.

N80-18018# Analytic Sciences Corp., Reading, Mass.
DIFFERENTIAL OMEGA IN THE ALASKA/YUKON REGION: AN ANALYTIC ASSESSMENT Final Report, Oct. 1978 - Jul. 1979
James M. Foltz, Barry E. Griffiths, Richard D. Healy, and Radha R. Gupta Aug. 1979 94 p refs
(Contract DOT-FA78WA-4236)
(AD-A078517; FAA-RD-79-77; TR-1579-1) Avail: NTIS HC A05/MF A01 CSCL 17/7

A differential navigation system for improving the navigation performance of airborne equipment in the vicinity of a fixed site ground station is evaluated. An error model for signal propagation prediction residuals is used to predict performance achievable with ground station and airborne equipment sites. Predictions are made for use of the equipment as a nonprecision approach aid within the differential system coverage area, and for use as an enroute navigation aid between areas serviced by a differential system ground station. System implementation in the Alaska/Yukon region is specifically addressed. M.G.

N80-18019*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RIM INERTIAL MEASURING SYSTEM Patent Application
Nelson J. Groom, Willard W. Anderson, and William H. Phillips, inventors (to NASA) Filed 7 Dec. 1979 27 p
(NASA-Case-LAR-12052-1; US-Patent-Appl-SN-102002) Avail: NTIS HC A03/MF A01 CSCL 17G

A strapdown inertial measuring system for measuring angular rate and linear accelerations about a spacecraft is disclosed. The system uses an annular momentum control device (AMCD) as the basic sensor. Features of the device include reliability, zero friction, zero wear, low volume, high momentum to mass ratio, and zero breakout forces. The AMCD is comprised of a rim and several magnetic bearing stations to control the position of the rim in the axial and radial directions. Signals from axial position sensors are used to compute the angular rates about first and second mutually perpendicular axes in the plane or the rim and the linear acceleration along a third axis perpendicular to the first and second axes. Signals from radial position sensors are used to compute the linear accelerations along the first and second axes. J.M.S.

N80-18020*# Research Triangle Inst., Durham, N. C.
CONTINUED STUDY OF NAVSTAR/GPS FOR GENERAL AVIATION Final Report
R. D. Alberts and W. H. Ruedger Dec. 1979 214 p refs
(Contract NAS1-14719)
(NASA-CR-159145; RTI-1404-00-01F) Avail: NTIS HC A10/MF A01 CSCL 17G

A conceptual approach for examining the full potential of Global Positioning Systems (GPS) for the general aviation community is presented. Aspects of an experimental program to demonstrate these concepts are discussed. The report concludes with the observation that the true potential of GPS can only be exploited by utilization in concert with a data link. The capability afforded by the combination of position location and reporting stimulates the concept of GPS providing the auxiliary functions of collision avoidance, and approach and landing guidance. A series of general recommendations for future NASA and civil community efforts in order to continue to support GPS for general aviation are included. R.E.S.

N80-18021*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT PERFORMANCE OF THE TCV B-737 AIRPLANE AT JORGE NEWBERRY AIRPORT, BUENOS AIRES, ARGENTINA USING TRSB/MLS GUIDANCE
William F. White and Leonard Clark Jan. 1980 41 p refs
(NASA-TM-80223) Avail: NTIS HC A03/MF A01 CSCL 17G

The flight performance of the Terminal Configured Vehicle airplane is summarized. Demonstration automatic approaches and landings utilizing time reference scanning beam microwave landing system (TRSB/MLS) guidance are presented. The TRSB/MLS was shown to provide the terminal area guidance necessary for flying curved automatic approaches with final legs as short as 2 km. R.E.S.

N80-18022# Texas Instruments, Inc., Dallas. Equipment Group.

GLOBAL POSITIONING SYSTEMS (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE). VOLUME 2: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979

15 Aug. 1979 283 p

(Contract F04701-75-C-0181)

(AD-A076483; SAMSO-SD-TR-79-13-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 17/7

This volume describes the design of the MVUE set as implemented in phase 1 of GPS, to include set description, software overview; and software/hardware subsystem descriptions. GRA

N80-18023# Texas Instruments, Inc., Dallas. Equipment Group.

GLOBAL POSITIONING SYSTEM (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE). VOLUME 3: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979

15 Aug. 1979 431 p refs

(Contract F04701-75-C-0181)

(AD-A076484; SAMSO-SD-TR-79-13-Vol-3) Avail: NTIS HC A19/MF A01 CSCL 17/7

This volume provides module level descriptions for each of the modules which make up the MVUE software and hardware subsystems. GRA

N80-18024# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

HELICOPTER REMOTE WIND SENSOR SYSTEM DESCRIPTION

D. H. Dickson and Charles M. Sonnenschein Sep. 1979 57 p

(DA Proj. 1L1-62111-AH-71)

(AD-A076153; ERADCOM/ASL-TR-0040) Avail: NTIS HC A04/MF A01 CSCL 14/2

The helicopter remote wind sensor (HRWS) is an application of a laser Doppler velocimeter. This system description describes the HRWS fabricated by Raytheon Company for the US Army Atmospheric Sciences Laboratory. The HRWS was designed to measure wind fields in an aircraft turbulent environment. The operational emphasis is to augment an attack helicopter's fire control system. This CO2 laser heterodyne system remotely measures three dimensional winds from 1 to 33 meters in front of the sensor. The HRWS was mounted in an external pod compatible with AH-1, AAH and UH-1 wing stores or a fixed wing aircraft equipped with standard wing shackles. The HRWS theory, functions, and subsystem are discussed. Data from flight and ground testing will be presented in a later report. GRA

N80-18025# Intermetrics, Inc., Cambridge, Mass.

GPS AND EAR/GEANS SOFTWARE SUPPORT Final Report, Dec. 1976 - Jun. 1979

N. A. Carlson, W. S. Widnall, P. K. Sinha, P. A. Grundy, and L. F. Wiederholt Aug. 1979 166 p refs

(Contract F33615-77-C-1044; AF Proj. 666A)

(AD-A078607; IR-397; AFAL-TR-79-1127) Avail: NTIS HC A08/MF A01 CSCL 17/7

The Air Force Avionics Laboratory is sponsoring development of both the Generalized Development Model (GDM) of GPS User equipment, and the EAR/GEANS radar/inertial navigator. This report documents results of analysis and software support for both of these programs. GPS-related analysis has been performed in the area of GDM software support, particularly, stability analysis of alternate designs for rate-aiding of non-coherent mode of GPS receiver; vertical channel analysis and simulation; improved GPS/Inertial Simulator model implementation; and integrated GPS/strapdown performance studies. EAR/GEANS-related analysis has been performed in the areas of Error Isolation Filter (EIF) development planning; vertical channel error modeling; error modeling for GEANS space-stable baro-inertial navigator; EAR radar measurement modeling; EAR/GEANS flight test data recording; gravity perturbation modeling; EAR/GEANS Error Isolation Filter synthesis; onboard feedback correction compensation in the EIF; and EIF optimal filter/smoother mechanization equations selection. GRA

N80-18026# Virginia Univ., Charlottesville. Research Labs for the Engineering Sciences.

DISCRETE ANALOG PROCESSING FOR TRACKING AND GUIDANCE CONTROL Final Report, 1 Aug. 1978 - 31 Aug. 1979

E. S. McVey, E. A. Parrish, R. M. Inigo, and R. J. Schalkoff 31 Aug. 1979 179 p refs

(Contract N00014-78-C-0695)

(AD-A078809; UVA/525350/EE79/102; ONR-CR-233-092-1) Avail: NTIS HC A09/MF A01 CSCL 17/7

The search for and development of algorithms for a real-time, automatic system capable of tracking 2-D targets in complex scenes is discussed. The problems and constraints involved in such an undertaking as well as previous efforts are summarized. No algorithms could be found in the literature that will provide satisfactory results for realistic conditions. A mathematical model of scene spatial and temporal evolution is developed for certain classes of targets and target perturbations. It is shown that for small target perturbations the 2-D tracking problem may be approximated as a 1-D time-varying parameter estimation problem. A novel and CCD-implementable solution is developed which is superior to previously developed algorithms, particularly when considering target rotation and dilation and target/background separation. Results of system simulation and suggestions for future research are presented. GRA

N80-18027# Research Inst. of National Defence, Linkoeping (Sweden).

OMEGA MEASUREMENTS IN STOCKHOLM [OMEGAMAETNINGAR I STOCKHOLM]

Bertil Landkvist Mar. 1979 84 p refs In SWEDISH

(FOA-C-20296-E3) Avail: NTIS HC A05/MF A01

A measurement device registering and evaluating automatically the Omega and Decca navigation system positions in latitude and longitude is presented. This equipment was initially designed for Omega navigation system but can also be used for the Decca navigation system. No special Decca navigation hyperbolic charts are needed when using this device. The results are presented in form of tables and diagrams. The two sigma limits of the position estimation error are reduced from 5-6 nautical miles to 1.5-3 nautical miles. Author (ESA)

N80-18069*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AN EVALUATION CRITERIA MODEL FOR THE NAVIGATION NETWORK SYSTEM DESIGN

In its The Deep Space Network 15 Feb. 1980 p 68-78 (For primary document see N80-18058 09-12)

Avail: NTIS HC A07/MF A01

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N80-18028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TERMINAL CONFIGURED VEHICLE PROGRAM: TEST FACILITIES GUIDE

Washington 1980 67 p refs

(NASA-SP-435) Avail: NTIS HC A04/MF A01 CSCL 01C

The terminal configured vehicle (TCV) program was established to conduct research and to develop and evaluate aircraft and flight management system technology concepts that will benefit conventional take off and landing operations in the terminal area. Emphasis is placed on the development of operating methods for the highly automated environment anticipated in the future. The program involves analyses, simulation, and flight experiments. Flight experiments are conducted using a modified Boeing 737 airplane equipped with highly flexible display and control equipment and an aft flight deck for research purposes. The experimental systems of the Boeing 737 are described including the flight control computer systems, the navigation/guidance system, the control and command panel, and the electronic display system. The ground based facilities used in the program are described including the visual motion simulator, the fixed base simulator, the verification and validation laboratory, and the radio frequency anechoic facility. A.W.H.

N80-18029*# Boeing Vertol Co., Philadelphia, Pa.
SYNTHESIS OF ROTOR TEST DATA FOR REAL-TIME SIMULATION
M. A. McVeigh Mar. 1979 232 p refs
(Contract NAS2-9015)
(NASA-CR-152311; D210-11505-1) Avail: NTIS HC A11/MF A01 CSCL 01C

A mathematical model of a hingeless tilting rotor is presented. The model was obtained by a systematic curve fit procedure applied to an extensive set of model scale wind tunnel data. The math model equations were used in a real time flight simulation model of a hingeless tilt rotor XV-15 to assess changes in flying qualities compared to those obtained using a previous rotor model. Extensive plots of the rotor derivatives are given. Discussions of attempts to apply multivariable linear regression techniques to the data and the use of an analytical rotor representation are included. Author

N80-18030*# Boeing Vertol Co., Philadelphia, Pa.
A HINGELESS ROTOR XV-15 DESIGN INTEGRATION FEASIBILITY STUDY. VOLUME 1: ENGINEERING DESIGN STUDIES Final Report
J. P. Magee and H. R. Alexander Mar. 1978 473 p
(Contract NAS2-9015)
(NASA-CR-152310; D210-11360-1-Vol-1) Avail: NTIS HC A20/MF A01 CSCL 01C

A design integration feasibility study was carried out to investigate what modifications to the basic XV-15 were necessary to accomplish a flight demonstration of the XV-15 with a Boeing hingeless rotor. Also investigated were additional modifications which would exploit the full capability provided by the combination of the new rotor and the existing T53 engine. An evaluation of the aircraft is presented and the data indicate improved air vehicle performance, acceptable aeroeleastic margins, lower noise levels and improved flying qualities compared with the XV-15 aircraft. Inspection of the rotor system data provided shows an essentially unlimited life rotor for the flight spectrum anticipated for the XV-15. R.E.S.

N80-18031*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
CONCEPTS FOR GENERATING OPTIMUM VERTICAL FLIGHT PROFILES
John A. Sorensen Sep. 1979 107 p refs
(Contract NAS1-15497)
(NASA-CR-159181) Avail: NTIS HC A06/MF A01 CSCL 01C

Algorithms for generating optimum vertical profiles are derived and examined. These algorithms form the basis for the design of onboard flight management concepts. The variations in the optimum vertical profiles (resulting from these concepts) due to variations in wind, takeoff weight, and range-to-destination are presented. Further considerations for mechanizing two different onboard methods of computing near-optimum flight profiles are then outlined. Finally, the results are summarized, and recommendations are made for further work. Technical details of optimum trajectory design, steering requirements for following these trajectories, and off-line computer programs for testing the concepts are included. J.M.S.

N80-18032*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PERFORMANCE ESTIMATES OF A BOEING 747-100 TRANSPORT MATED WITH AN OUTSIZE CARGO POD
Lloyd S. Jernell Feb. 1980 20 p refs
(NASA-TM-80227) Avail: NTIS HC A02/MF A01 CSCL 01C

The design mission performance of a Boeing 747-100 aircraft mated with an outsize cargo pod was studied. The basic design requirement was the rapid deployment of a combat loaded mobile bridge launcher from a United States east coast staging base to Europe. Weight was minimized by stripping the aircraft of unneeded, quick removal items and by utilizing graphite-epoxy composite materials for most pod components. The mission analysis was based on wind tunnel data and full scale carrier aircraft and engine data. The results are presented in tabular and graphic form. A.W.H.

N80-18033# North American Rockwell Corp., El Segundo, Calif.
AIRCRAFT TRANSPARENCY FAILURE AND LOGISTICAL COST ANALYSIS: SUPPLEMENTAL STUDY Final Report, Feb. - Jun. 1979
S. S. Bronn Wright-Patterson AFB, Ohio AFFDL Jun. 1979 250 p refs
(Contract F33615-77-C-3060; AF Proj. 2402)
(AD-A075500; NA-79-237; AFFDL-TR-79-3083) Avail: NTIS HC A11/MF A01 CSCL 01/3

Concern for increasing costs in maintenance of transparency systems has prompted the Air Force Flight Dynamics Laboratory to sponsor this study contract. The object of this study is to identify the high-cost, high maintenance transparency components; identify cause of failures; and recommend corrective programs to reduce cost of ownership to the Air Force Logistics Command. The study involved the review of 20 selected aircraft in current inventory to establish an extensive data base relating transparency maintenance activity and associated logistical support costs. An important adjunct to this study was to research design characteristics, perform a failure analysis, and identify associated logistical support cost for each study aircraft. By using a selective process of correlating the transparency failure modes and maintenance costs with the relative stature of aircraft in current inventory, corrective programs were established and verified by life-cycle cost trades. These corrective programs entailed a comprehensive search for various design improvement that could be innovated to negate the reported failures. The study results contained herein are an extension of objectives of the original program and are directed at supplementing the corrective programs for six additional aircraft. GRA

N80-18034# Naval Air Development Center, Warminster, Pa.
DESIGN AND TEST OF A BORON - ALUMINUM HIGH TEMPERATURE WING Final Report
R. J. Richey and T. E. Hess May 1979 106 p refs
(AD-A075814; NADC-79145-60) Avail: NTIS HC A06/MF A01 CSCL 01/3

The feasibility of utilizing the high buckling stability characteristics of boron - aluminum advanced composite material in a simple, low-cost spar-rib-skin construction for a thin airfoil structure was investigated for high temperature application up to 589 K. The design concept developed consists of boron-aluminum skins, to carry the primary bending and torsion loads, mechanically fastened to a light gage steel sub-structure, which resists transverse shear and stabilizes the skins. The viability of the concept depends on whether this stabilization of the skin material can be accomplished with a practical number and spacing of substructure elements. A weight saving of one third in comparison to the production article is projected in this boron-aluminum version of the BYM-34E wing. A major wing subcomponent was fabricated and static tested to validate the structural adequacy of the overall design. GRA

N80-18035# Boeing Aerospace Co., Seattle, Wash.
NEW REMOTELY PILOTED VEHICLE LAUNCH AND RECOVERY CONCEPTS: COMPUTER PROGRAM LISTINGS Final Report, Mar. 1978 - Mar. 1979
Steven J. Baumgartner, Roger F. Yurczyk, James G. Brister, and Vinod K. Rajpaul Jun. 1979 173 p
(Contract F33615-78-C-3404; AF Proj. 2402)
(AD-A076611; AFFDL-TR-79-3069-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 01/3

Dynamic analysis, preliminary design, and performance/cost trade studies of air bag skid and air cushion concepts for launch and recovery of Boeing and Rockwell advanced RPV concepts have been conducted. Dynamic analysis was performed using the six degree-of-freedom computer program EASY. Dynamic simulations included perturbations to steady state flight, landing, and takeoff simulations. Launch and recovery concepts investigated were air bag skid system, air cushion recovery system, integrated air cushion system, and air cushion launch platform. Performance/cost trade study factors investigated were complexity, fuel requirements, adverse weather capability, ground equipment and facility requirements, survivability, reliability and maintainability, and system acquisition and life cycle costs. Results of the study indicated that an air cushion system is a feasible means of recovery of an RPV such as the Boeing and Rockwell ARPV concepts. An air bag skid with an arrestor system is a feasible approach when minimum field length is a major design factor. Integrated air cushion system for launch and recovery are greatly affected by engine characteristics. In each case, the launch and recovery systems are shown to be an integral part of the total vehicle design and strongly influences the airframe design. GRA

N80-18229 McDonnell-Douglas Astronautics Co., St. Louis, Mo.
TURBULENT-BOUNDARY-LAYER EXCITATION AND RESPONSE THERETO FOR A HIGH-PERFORMANCE CONICAL VEHICLE
C. M. Ailman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 159-169 refs
(For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N80-18036* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
AIR SPEED AND ATTITUDE PROBE Patent
Gerald J. Baker and Merle A. Economu, inventors (to NASA) Issued 15 Jan. 1980 6 p Filed 30 May 1978 Supersedes N78-25088 (16 - 16, p 2077)
(NASA-Case-FRC-11009-1; US-Patent-4,184,149;
US-Patent-Appl-SN-910708; US-Patent-Class-340-177VA;
US-Patent-Class-73-188; US-Patent-Class-73-189;
US-Patent-Class-73-212) Avail: US Patent and Trademark Office CSCL 01D

An air speed and attitude probe characterized by a pivot shaft normally projected from a data boom and supported thereby for rotation about an axis of rotation coincident with the longitudinal axis of the shaft is described. The probe is a tubular body supported for angular displacement about the axis of rotation and has a fin mounted on the body for maintaining one end of the body in facing relation with relative wind and has a pair of transducers mounted in the body for providing intelligence indicative of total pressure and static pressure for use in determining air speed. A stack of potentiometers coupled with the shaft to provide intelligence indicative of aircraft attitude, and circuitry connecting the transducers and potentiometers to suitable telemetry circuits are described.

Official Gazette of the U.S. Patent and Trademark Office

N80-18037*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EARLY FLIGHT TEST EXPERIENCE WITH COCKPIT DISPLAYED TRAFFIC INFORMATION (CDTI)
Terence S. Abbott, Gene C. Moen (Army Res. and Technol. Labs., Hampton, Va.), Lee H. Person, Jr., Gerald L. Keyser, Jr., Kenneth R. Yenni, and John F. Garren Feb. 1980 31 p refs
(DA Proj. 1L2-62209-AH-76)
(NASA-TM-80221; AVRADCOM-TR-80-B-2) Avail: NTIS HC A03/MF A01 CSCL 01D

Coded symbology, based on the results of early human factors studies, was displayed on the electronic horizontal situation indicator and flight tested on an advanced research aircraft in order to subject the coded traffic symbology to a realistic flight environment and to assess its value by means of a direct comparison with simple, uncoded traffic symbology. The tests consisted of 28 curved, decelerating approaches, flown by research-pilot flight crews. The traffic scenarios involved both conflict-free and blunder situations. Subjective pilot commentary was obtained through the use of a questionnaire and extensive pilot debriefing sessions. The results of these debriefing sessions group conveniently under either of two categories: display factors or task performance. A major item under the display factor category was the problem of display clutter. The primary contributors to clutter were the use of large map-scale factors, the use of traffic data blocks, and the presentation of more than a few aircraft. In terms of task performance, the cockpit displayed traffic information was found to provide excellent overall situation awareness. R.E.S.

N80-18038*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF VIEWING TIME, TIME TO ENCOUNTER, AND PRACTICE ON PERCEPTION OF AIRCRAFT SEPARATION ON A COCKPIT DISPLAY OF TRAFFIC INFORMATION
Sharon OConnor, Everett Palmer, Daniel Baty, and Sharon Jago Feb. 1980 17 p refs Prepared in cooperation with San Jose State Univ., Calif.
(Grant NsG-2269)
(NASA-TM-81173; A-8072) Avail: NTIS HC A02/MF A01 CSCL 01D

The concept of a cockpit display of traffic information (CDTI) includes the integration of air traffic, navigation, and other pertinent information in a single electronic display in the cockpit. Two studies were conducted to develop a clear and concise display format for use in later full-mission simulator evaluations of the CDTI concept. Subjects were required to monitor a CDTI for specified periods of time and to make perceptual judgments concerning the future position of a single intruder aircraft in relationship to their own aircraft. Experimental variables included: type of predictor information displayed on the two aircraft symbols; time to encounter point; length of time subjects viewed the display; amount of practice; and type of encounter (straight or turning). Results show that length of viewing time had little or no effect on performance; time to encounter influenced performance with the straight predictor but did not with the curved predictor; and that learning occurred under all conditions. R.E.S.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-18039* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND APPARATUS FOR RAPID THRUST INCREASES IN A TURBOFAN ENGINE Patent
Jack E. Cornett (GE, Cincinnati, Ohio), Ralph C. Corley (GE, Cincinnati, Ohio), Thomas O. Fraley (GE, Cincinnati, Ohio), and Andrew A. Saunders, Jr., inventors (to NASA) (GE, Cincinnati, Ohio) Issued 22 Jan. 1980 9 p Filed 9 Dec. 1977 Sponsored by NASA
(NASA-Case-LEW-12971-1; US-Patent-4,184,327 ;
US-Patent-Appl-SN-858936; US-Patent-Class-60-240;
US-Patent-Class-60-39.03; US-Patent-Class-60-39.27) Avail: US Patent and Trademark Office CSCL 21E

Upon a landing approach, the normal compressor stator schedule of a fan speed controlled turbofan engine is temporarily varied to substantially close the stators to thereby increase the fuel flow and compressor speed in order to maintain fan speed and thrust. This running of the compressor at an off-design speed substantially reduces the time required to subsequently advance the engine speed to the takeoff thrust level by advancing the throttle and opening the compressor stators.

Official Gazette of the U.S. Patent and Trademark Office

N80-18040*# Little (Arthur D.), Inc., Cambridge, Mass.
STUDY OF RESEARCH AND DEVELOPMENT REQUIREMENTS OF SMALL GAS-TURBINE COMBUSTORS
E. P. Demetri, R. F. Topping, and R. P. Wilson, Jr. Jan. 1980 69 p refs
(Contract NAS3-21980)
(NASA-CR-159796; ADL-83381-2) Avail: NTIS HC A04/MF A01 CSCL 21E

A survey is presented of the major small-engine manufacturers and governmental users. A consensus was undertaken regarding small-combustor requirements. The results presented are based on an evaluation of the information obtained in the course of the study. The current status of small-combustor technology is reviewed. The principal problems lie in liner cooling, fuel injection, part-power performance, and ignition. Projections of future engine requirements and their effect on the combustor are discussed. The major changes anticipated are significant increases in operating pressure and temperature levels and greater capability of using heavier alternative fuels. All aspects of combustor design are affected, but the principal impact is on liner durability. An R&D plan which addresses the critical combustor needs is described. The plan consists of 15 recommended programs for achieving necessary advances in the areas of liner thermal design, primary-zone performance, fuel injection, dilution, analytical modeling, and alternative-fuel utilization. M.M.M.

N80-18041*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
INTERNAL COATING OF AIR COOLED GAS TURBINE BLADES Final Report
P. L. Ahuja Nov. 1979 73 p refs
(Contract NAS3-21038)
(NASA-CR-159701) Avail: NTIS HC A04/MF A01 CSCL 21E

Six coating systems were evaluated for internal coating of decent stage (DS) eutectic high pressure turbine blades. Sequential deposition of electroless Ni by the hydrazine process, slurry Cr, and slurry Al, followed by heat treatment provided the coating composition and thickness for internal coating of DS eutectic turbine blades. Both NiCr and NiCrAl coating compositions were evaluated for strain capability and ductile to brittle transition temperature. R.C.T.

N80-18042*# Vought Corp., Dallas, Tex.
LOW SPEED TEST OF THE AFT INLET DESIGNED FOR A TANDEM FAN V/STOL NACELLE
W. W. Rhoades and A. H. Ybarra Feb. 1980 79 p refs
(Contract NAS3-21468)
(NASA-CR-159752; TR-2-30320/OR-52360) Avail: NTIS HC A05/MF A01 CSCL 21E

An approximately .25 scale model of a Tandem Fan nacelle designed for a Type A V/STOL aircraft configuration was tested in a 10-by-10 foot wind tunnel. A 12 inch, tip driven, turbofan simulator was used to provide the suction source for the aft fan inlet. The front fan inlet was faired over for this test entry. Model variables consisted of a long aft inlet cowl, a short aft inlet cowl, a shaft simulator, blow-in door passages and diffuser vortex generators. Inlet pressure recovery, distortion, inlet angle of attack separation limits were evaluated at tunnel velocities from 0 to 240 knots, angles of attack from -10 to 40 degrees and inlet flow rates representative of throat Mach numbers of 0.1 to 0.6. High inlet performance and stable operation was verified at all design forward speed and angle of attack conditions. The short aft inlet configuration provided exceptionally high pressure recovery except at the highest combination of angle of attack and forward speed. The flow quality at the fan face was somewhat degraded by the addition of blow-in door passages to the long aft inlet configuration due to the pressure disturbances generated by the flow entering the diffuser through the auxiliary air passages. M.M.M.

N80-18043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION IN YEAR 2000
Richard J. Weber 1980 18 p refs Proposed for presentation at Global Technol. 2000, the 1980 Intern. Meeting of the Am. Inst. of Aeron. and Astronautics, Baltimore, 5-11 May 1980
21A

A sampling of probable future engine types, such as convertible engines for helicopters, turboprops for fuel-conservative airliners, and variable-cycle engines for supersonic transports are presented. Related technology improvements in propellers, materials, noise suppression, etc. are reviewed. R.E.S.

N80-18044# Ohio State Univ. Research Foundation, Columbus.
INVESTIGATION OF THE BOUNDARY LAYER BEHAVIOR ON TURBINE AIRFOILS Final Report, 16 Jun. 1975 - 15 Dec. 1978
Lit S. Han, Wesley R. Cox, and Arnon Chait Aug. 1979 273 p refs
(Contract F33615-75-C-2052; AF Proj. 3066)
(AD-A075501; OSURF/760256/784174; AFAPL-TR-79-2011) Avail: NTIS HC A12/MF A01 CSCL 20/4

Smoke flow visualization, hot-wire anemometer, and pressure distribution studies were conducted to determine some of the wake and pressure surface boundary layer transition region characteristics along an enlarged two-dimensional turbine airfoil model in cascade. Smooth surface as well as rough surface airfoils were used in the study, which utilized a continuous, subsonic, specially built wind-tunnel. The flow provided a range of blade chord Reynolds numbers from 7.9E - 5 1.5E - 6 at turbulence levels of 0.6 to 0.8%. A pressure surface transition region was found to exist from about S/C = 0.43 to the trailing edge for the smooth surface airfoil, and up to S/C = 0.1 for a rough surface airfoil. The transition region for a smooth surface was initiated through the formation of Goertler vortices which were found to break down through the action of traveling Tollmein-Schlichting waves. Other phenomena observed include various trailing edge vortex formations which may be linked to the intermittency of the boundary layer near the trailing edge, and a low frequency traveling wave formed in conjunction with the appearance of traveling waves. An empirical relationship was developed for the traveling wave frequency. Comparison was made with stability theory and empirical methods of predicting transition. Linear stability theory was found to predict the Goertler wavelength, but not that of the traveling waves. GRA

N80-18045# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 7TH ANN. TRI-SERVICE MEETING FOR AIRCRAFT ENGINE MONITORING AND DIAGNOSTICS Final Report, 5-7 Dec. 1978
James L. Pettigrew and Keith Hamilton Jul. 1979 284 p Meeting held at Arnold Air Force Station, Tenn., 5-7 Dec. 1978
(AD-A076126; ASD-TR-79-5040) Avail: NTIS HC A13/MF A01 CSCL 21/5

These proceedings contain an edited compilation of the presentations of government agencies at the Seventh Tri-Service Diagnostic Conference held at Arnold Engineering Development Center, Arnold Air Force Station Tennessee 5-7 Dec 1978. The program themes were current experience service needs and technology thrusts in aircraft turbine engine monitoring and diagnostics. Working level representatives from the maintenance organization of operating and support commands gave their views on the requirements for specific diagnostic and maintenance decision information. GRA

N80-18046# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF F-16 NOZZLE-AFTERBODY FORCES AT TRANSONIC MACH NUMBERS WITH EMPHASIS ON SUPPORT SYSTEM INTERFERENCE Final Report, Jan. - Jul. 1978
Earl A. Price, Jr. AEDC Dec. 1979 207 p refs Sponsored by the Air Force
(AD-A078693; AEDC-TR-79-56; AFAPL-TR-79-2099) Avail: NTIS HC A10/MF A01 CSCL 20/4

A comprehensive experimental program was conducted to provide nozzle-afterbody data with a minimum interference support system on a 1/9-scale F-16 model and to determine the interference induced on the afterbody-nozzle region by a sting, a wingtip, and a strut model support system. The investigation was conducted over the Mach number range from 0.6 to 1.5 and at angles of attack from 0 to 9 deg. Interference was evaluated by comparison of nozzle-afterbody axial and normal forces obtained from integrating pressure data. The results include parametric studies of the effects of various components of the wingtip support system (i.e., the support blade axial position, wingtip boom diameter, boom spacing, and boom-tip axial location). High-pressure air at ambient temperature was utilized for exhaust plume simulation. The results indicate that a sting support passing through the nozzle with the jet effects simulated by an annular jet appears to offer a minimum interference support system for the type of nozzle-afterbody test described in this report. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-18047*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
V/STOLAND AVIONICS SYSTEM FLIGHT-TEST DATA ON A UH-1H HELICOPTER
Fredric A. Baker, Dean N. Jaynes, Lloyd D. Corliss, Sam Liden (Sperry Rand Corp., Phoenix, Ariz.), Robert B. Merrick, and Daniel C. Dugan Feb. 1980 68 p refs
(NASA-TM-78591; A-7831) Avail: NTIS HC A04/MF A01 CSCL 01C

The flight-acceptance test results obtained during the acceptance tests of the V/STOLAND (versatile simplex digital avionics system) digital avionics system on a Bell UH-1H helicopter in 1977 at Ames Research Center are presented. The system provides navigation, guidance, control, and display functions for NASA terminal area VTOL research programs and for the Army handling qualities research programs at Ames Research Center. The acceptance test verified system performance and contractual acceptability. The V/STOLAND hardware navigation, guidance, and control laws resident in the digital computers are described. Typical flight-test data are shown and discussed as documentation of the system performance at acceptance from the contractor. M.M.M.

N80-18048*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THRUST AUGMENTED SPIN RECOVERY DEVICE Patent Application
Bobby L. Berrier, inventor (to NASA) Filed 27 Apr. 1979 15 p
(NASA-Case-LAR-11970-2; US-Patent-Appl-SN-034104) Avail: NTIS HC A02/MF A01 CSCL 01C

A lightweight and drag-free yaw control system developed for a jet propelled aircraft is described. Emphasis is placed on providing aircraft attitude control at low flight speeds, at high angles of attack, and during spin. The control system is comprised of a vertical tail with a thrust augmented rudder and a thrust rudder tab. The jet exhaust stream is deflected by the thrust vectoring rudder tab in a sideward direction to the aircraft, producing a thrust vectored yawing moment and creating supercirculation about the vertical tail and thrust augmented rudder. Supercirculation, a thrust-induced aerodynamic phenomenon, generates lift without increasing drag, enabling the rudder to provide additional yawing force for attitude control. J.M.S.

N80-18049# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
UNSTEADY EFFECTS WITH CONTROL SURFACES [EFFETS INSTATIONNAIRES DES GOUVERNES]
Richard Grenon and Andre Desopper Assoc. Aeron. et Astronautique de France 1979 14 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-01; ISBN-2-7170-0528-5) Avail: NTIS HC A02/MF A01; CEDOCAR; Paris FF 17 (France and EEC) FF 21 (others)

The unsteady phenomena observable around control surfaces in subsonic and transonic flow is discussed. Results obtained with an airfoil profile equipped with a trailing edge flap moving sinusoidally in a two dimensional subsonic or transonic flow regime are reported. Steady and unsteady pressure measurements made during wind tunnel tests are given. A comparison is made between these measurements and results for the steady and unsteady flow field of a perfect fluid. An attempt is made to take into consideration viscous effects. Results show that theory does not satisfactorily describe coupling phenomena, notably flow separation and the interaction between the shock front and the boundary layer. Author (ESA)

N80-18050# Aerospatiale Usines de Toulouse (France). Helicopters Div.
ROTORS IN FORWARD FLIGHT AND DYNAMIC STALL [PALE RECULANTE ET DECROCHAGE DYNAMIQUE]
J. Renaud Paris Assoc. Aeron. et Astronique de France 1979 26 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-20; ISBN-2-7170-0547-1) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

Dynamic stall of rotors in forward flight is studied in terms of the limiting on helicopter performance. Manifestations of the phenomena depend on the characteristics of the rotors and on operating conditions. The lift of the rotor, forward velocity, engine speed, and the interaction of vortices with the blade surface all contribute to the development of stall. Experiments demonstrating the unsteady nature of the phenomena are reported. Simulation of dynamic stall phenomena on an oscillating model shows that the delay in unsteady stalling is associated with the development of a system of vortices along the leading edge. A two dimensional analysis is used in modeling dynamic stall. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-18051# Yang (Nai C.) and Associates, New York, N.Y.
NONDESTRUCTIVE EVALUATION OF AIRPORT PAVEMENTS. VOLUME 1: PROGRAM REFERENCES
Nai C. Yang Sep. 1979 173 p
(Contract DOT-FA77WA-3964)
(AD-A078835; FAA-RD-78-154-1) Avail: NTIS HC A08/MF A01 CSCL 13/2

The concept of nondestructive evaluation and functional pavement design was integrated into a computer program which is described. The program logic and operational procedures used in the computer program are outlined as follows. The nondestructive test (NDT) is used as a substitute for the plate load test without interference to airport operation. The evaluation and design segment evaluates the strength by cumulative stress damage and progressive surface deformation. The final program output is the cost information for ten design alternatives of equal functional performance. The validation program makes the correlations between the NDT data and subgrage geology, regional climate, airport operation, existing pavements, and response of airport bridges. A.W.H.

N80-18052# *Permali, Inc., Mount Pleasant, Pa.*
DEVELOPMENT AND TEST OF LOW-IMPACT RESISTANT TOWERS Final Report
Eugene T. Rogers, Jonathan A. Ross, and Kenneth M. Snyder Aug. 1979 76 p
(Contract DOT-FA78WA-4152)
(AD-A077160; W79005; FAA-AF-79-1) Avail: NTIS HC A05/MF A01 CSCL 01/5

A break-away fiberglass mast for use in low impact resistant (LIR) structures to support airport approach lighting systems was developed. This design will withstand 100 mph winds (including gusts) without ice and 75 mph winds (including gusts) with a 1/2 inch radial ice load. Yet, when struck by a light airplane wind, it breaks into pieces without catastrophic damage to the wing. It was observed that impact energy needed to break the mast was in the order of 679 foot-pounds and that peak forces were in the order of 5,656 lbs. J.M.S.

N80-18053# Aeronautical Research Labs., Melbourne (Australia).
COMPUTER SYNTHESIS OF FLIGHT SIMULATION VISUALS
John Sandor Feb. 1979 36 p refs
(ARL/SYS-Note-61; AR-001-593) Avail: NTIS HC A03/MF A01

The principles of computer synthesis of external world visuals for faster display are reviewed. The areas of environment description, edge and polygon clipping, hidden surface removal, shading, and image aberrations are discussed. Particular attention is given to hierarchical environment structure, image coherence, shading functions, and area averaging edge smoothing techniques. A.W.H.

N80-18054# Aeronautical Research Labs., Melbourne (Australia).
PROGRAMS FOR THE TRANSONIC WIND TUNNEL DATA PROCESSING INSTALLATION. PART 7: EXTENDED FOCAL
N. Pollock Mar. 1979 44 p refs
(AD-A073414; ARL/Aero-TM-314) Avail: NTIS HC A03/MF A01 CSCL 09/2

Since the transonic wind tunnel data processing installation, which is based on a PDP 8-I computer, was installed in 1968 a considerable library of standard programs have been produced. This program library covers all types of testing commonly carried out in the wind tunnel. However there remains the possibility of unusual tests being required which are not covered by existing programs. This memorandum describes modifications to the Digital Equipment Corporation FOCAL language (FOCAL is a keyboard oriented interpretive language similar to BASIC) which permit the tunnel instrumentation, display and plotter to be operated by FOCAL programs. Using this extended FOCAL language it should be possible to rapidly write and de-bug programs to meet unusual requirements not covered by the standard program library. GRA

N80-18055# Battelle Columbus Labs., Ohio.
METHODOLOGY FOR MAKING A SELF-ABSORPTION CORRECTION TO THE SIMPLE COPPER-LINE-RATIO TECHNIQUE USED FOR ARC-TUNNEL ENTHALPY MEASUREMENTS *Final Report, Oct. 1977 - Oct. 1978*
Anthony A. Boiarski Oct. 1979 77 p refs
(Contract F33615-76-C-3145; AF Proj. 2404)
(AD-A078686; AFFDL-TR-79-3122) Avail: NTIS HC A05/MF A01 CSCL 20/13

Detailed theory and analytical procedures are presented which provide a method for self-absorption correction of the simple 5106/5153 angstrom copper-line-ratio technique used to measure arc-tunnel stagnation enthalpy. This correction procedure involves simultaneous measurement of the 5106 angstrom line full half-width in order to infer copper number density and gas temperature from the self-absorption broadened line profile shape, and the simple one intensity ratio. Theoretical formulations of other dominant line-broadening contributions (i.e., Doppler, Van der Waals, and Stark effects) are also included in order to accurately determine the degree of line broadening that results from self-absorption alone. Typical data reduction curves are presented to demonstrate the correction process. These curves indicate that large errors in measured enthalpy could result if self-absorption was not properly accounted for in the data analysis procedure. An error estimate is also included to indicate the typical accuracy presently obtainable from this self-absorption correction method. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

N80-18056* National Aeronautics and Space Administration, Washington, D. C.
TECHNOLOGY FOR LARGE SPACE SYSTEMS. A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 2
20 Mar. 1980 106 p
(NASA-SP-7046(02)) Avail: NTIS HC A06 CSCL 22A

This bibliography lists 258 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1979 and December 31, 1979. Its purpose is to provide helpful information to the researcher, manager, and designer in technology development and mission design in the area of the Large Space Systems Technology (LSST) Program. Subject matter is grouped according to systems, interactive analysis and design, structural concepts, control systems, electronics, advanced materials, assembly concepts, propulsion, solar power satellite systems, and flight experiments. Author

N80-18057*# RAND Corp., Santa Monica, Calif.
CONTROL NETWORKS FOR THE GALILEAN SATELLITES, NOVEMBER 1979
Merton E. Davies, Thomas A. Hauge, Frank Y. Katayama, and James A. Roth Nov. 1979 70 p refs
(Contracts NASw-3210; JPL-953613)
(NASA-CR-162799; R-2532-JPL/NASA; ISBN-0-8330-0197-3) Avail: NTIS HC A04/MF A01 CSCL 22A

Pictures of the four Galilean satellites taken as the two Voyager spacecraft approached Jupiter during March and July 1979 are presented. Control nets of the Galilean satellites, computed photogrammetrically, and measurements of the mean radii are presented. The pictures in the control nets are identified, the coordinates of the control points are given, and identifications of some of the control points are shown on figures. The use of star field pictures to compute the focal lengths of the camera is discussed and the geometric relationship between the narrow and wide and angle cameras is reported. A description of the coordinate systems of the Galilean satellites is presented and the status of the control net computations is reported. A.W.H.

N80-18058*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK Progress Report, Nov. - Dec. 1979
15 Feb. 1980 131 p refs
(Contract NAS7-100)
(NASA-CR-162795; JPL-PR-42-55) Avail: NTIS HC A07/MF A01 CSCL 14B

The functions and facilities of the Deep Space Network are considered. Progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations is reported. For individual titles, see N80-18059 through N80-18073.

N80-18059*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES c14
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1980 p 1-4 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The objectives, functions, and organization of the Deep Space Network are summarized; deep space station, ground communication, and network operations control capabilities are described. Author

N80-18060*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION c15
R. L. Gillette *In its* The Deep Space Network 15 Feb. 1980 p 4-5 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

Viking Spacecraft activities from 1 April 1979 through 30 November 1979 are reported. The DSN Viking tracking support for the same periods included. J.M.S.

N80-18061*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT c14
G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1980 p 7-9 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The continuing Deep Space Network support of Pioneer

Mission Operations is reported. Information on the cruise phases of Pioneers 6-9, Pioneer 10, post-encounter coverage of Pioneer 11, Pioneer 12 orbital operations, and other mission-related activities is included. J.M.S.

N80-18062*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY c89
R. M. Taylor *In its* The Deep Space Network 15 Feb. 1980 p 10-11 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 03A

The activities of the Deep Space Network in support of radio astronomy operations during the period September 1979 to December 1979 are reported. J.M.S.

N80-18063*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRACTICAL LIMITATIONS ON NOISELESS OPTICAL CHANNEL CAPACITY c74
S. A. Butman, J. Katz, and J. R. Lesh *In its* The Deep Space Network 15 Feb. 1980 p 12-14 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20F

An optimization scheme under the constraint of a given information rate (in nats/second) and minimum time slot resolution is presented. It is shown that system efficiencies in excess of 10's of nats/photon will be extremely difficult to achieve due to fundamental time resolution limitations. J.M.S.

N80-18064*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ESTIMATING THE ANGULAR POSITION OF A MOVING DEEP SPACE VEHICLE USING TWO ROTATING TRACKING STATIONS c13
H. H. Tan *In its* The Deep Space Network 15 Feb. 1980 p 15-29 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

The problem of estimating the angular position of a deep space vehicle moving at a constant velocity using two rotating tracking stations is considered. The optimal attainable estimation performance and associated receiver design are included. Parametric dependence of the optimum attainable estimation performance is also studied. J.M.S.

N80-18065*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VALIDATION OF ROUNDTRIP CHARGED-PARTICLE CALIBRATIONS DERIVED FROM S- AND X-BAND DOPPLER VIA DRVID MEASUREMENTS c32
D. W. Green *In its* The Deep Space Network 15 Feb. 1980 p 30-40 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20N

It is shown that roundtrip signal path calibrations for charged particle effects can be computed from S- and X-band Doppler data. The method by which this is done is described, and possible error sources are examined. It is shown that roundtrip calibrations computed from S- and X-band Doppler compare to direct measurements using DRVID to within the DRVID data noise. J.M.S.

N80-18066*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPERATION OF JOULE-THOMPSON REFRIGERATION ABOVE THE CRITICAL PRESSURE OF HELIUM c31
D. L. Johnson *In its* The Deep Space Network 15 Feb. 1980 p 41-49 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20L

The refrigeration capacity of an existing refrigeration system was measured as a function of the supply pressure and the return pressure in the Joule-Thomson circuit. The performance of the refrigerator was calculated and compared to the ideal Carnot cycle refrigerator. K.L.

N80-18067*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY STUDY OF A SPACECRAFT SURVEILLANCE SYSTEM c14
C. A. Greenhall *In its* The Deep Space Network 15 Feb. 1980 p 50-62 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

The system for monitoring the health of the proposed International Comet Exploration spacecraft during its solar electric propulsion stage cruise mode is discussed. The system uses a commerical fast Fourier transform spectrum analyzer for noncoherent, synchronous detection of an alternating-tone signal received by a small parabolic antenna (0.8 to 3 m in diameter). Integration times vary from 3.7 to 9.5 min. K.L.

N80-18068*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PRACTICAL LIMITS OF PHOTON COMMUNICATION c32
R. J. McEliece, E. R. Rodemich, and A. L. Rubin *In its* The Deep Space Network 15 Feb. 1980 p 63-67 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

It is shown that for photon communication, the rate R sub o = 1 nat per photon is the rate beyond which an explosive increase is encountered in the required ratio of peak-to-average signal power and in the required bandwidth expansion. On the basis of these results, it is conjectured that no practical photon communication system can be designed to operate above 10 nats per photon. K.L.

N80-18069*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EVALUATION CRITERIA MODEL FOR THE NAVIGATION NETWORK SYSTEM DESIGN c04
In its The Deep Space Network 15 Feb. 1980 p 68-78 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01

The approaches used in developing the basis for a system design evaluation model are described. Two evaluation cases are modeled, leading to a general model that is then detailed for application specifically to the Navigation Network conceptual designs. The identification of the system attributes and their associated perspectives are discussed along with the method of scoring and ranking a candidate design. K.L.

N80-18070*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TROPOSPHERIC PATH LENGTH FLUCTUATION IN TEMPERATE SEMIARID LOCALES: APPLICATION TO THE GRAVITATIONAL WAVE DETECTION EXPERIMENT c46
A. L. Berman and S. D. Slobin *In its* The Deep Space Network 15 Feb. 1980 p 79-85 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 04A

Radiosonde data from Edwards Air Force Base and radio metric scintillation data collected over a long, nearly horizontal path in Hawaii investigated. Utilizing a hypothesis that wet tropospheric path length fluctuation is proportional to total wet tropospheric signal delay, the two types of data are shown to be in reasonable agreement for averagings times (tau sub a) of approximately 3000 seconds. The two-way modeled tropospheric fractional frequency fluctuation at tau sub a = 1000 seconds is 1.6 x 10 to the 14th power. K.L.

N80-18071*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GCF-NOCC RECONFIGURATION c60
J. P. McClure *In its* The Deep Space Network 15 Feb. 1980 p 86-89 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09B

Improvements in the operational capability of the equipment and computer programs in the Network Operations Control Center and the Ground Communications Facility Central Communications Terminal at JPL are documented. K.L.

N80-18072*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY TELEMETRY OPERATIONS EXPERIENCE WITH THE REAL-TIME COMBINER, 1 NOVEMBER 1978 TO 1 NOVEMBER 1979 c17
N. K. Simon and C. Hoynes *In its* The Deep Space Network 15 Feb.

1980 p 90-96 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09F

A prototype version of a two station, real time signal combiner was installed at Goldstone DSS 14/(12) and used to support the Voyager Mission at Jupiter and the Pioneer 11 Mission at Saturn. Early combined station operating experience with a real Time Combiner in the loop is reported. K.L.

N80-18073*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VITERBI DECODING MODIFIED FOR SOURCES WITH MEMORY c32
V. Kapwar *In its* The Deep Space Network 15 Feb. 1980 p 97-110 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

The gain in signal to noise ratio realized using redundancies inherent in TV data to modify the decoding metric of the DSN Viterbi decoders is investigated. This modification takes into account the memory in a TV scan line to change the transition probabilities as originally computed using independent data. The resulting data rate gain or error probability decrease is achieved without requiring any spacecraft modifications or additions. A preliminary examination of this concept on a binary symmetric channel using a simplified Markov source model involving two-level or hard-clipped TV demonstrates that very substantial decreases in error probability may be achieved. K.L.

N80-18074*# National Aeronautics and Space Administration, Washington, D. C.
THE WORLD OF TOMORROW: AEROSPACE ACTIVITIES FOR 8- TO 10-YEAR OLDS. A GUIDE FOR LEADERS OF CHILDREN'S GROUPS AND TEACHERS OF THE LOWER GRADES
1978 70 p Prepared in cooperation with the Boy Scouts of America, Dallas/Fort Worth Airport, Tex.
(NASA-EP-144) Avail: NTIS MF A01; SOD HC CSCL 22A

During January 1977, NASA helped the Cub Scout Division of the Boy Scouts of America in the conduct of its The World of Tomorrow monthly theme. In this period, 249 Cub Scout packs participated in a nationwide aerospace activities project, a pilot project in which den leaders and Cubmasters conducted local programs for their Cub Scouts and Webelos Scouts. The products of these local programs are presented with the written accounts submitted by adult leaders and written compositions, pictures, and photographs of models submitted by the youngsters. A.W.H.

N80-18075*# Brown Engineering Co., Inc., Huntsville, Ala. Space Systems Dept.
STRAWMAN PAYLOAD DATA FOR SCIENCE AND APPLICATIONS SPACE PLATFORMS Final Report
Jan. 1980 214 p
(Contract NAS8-32711)
(NASA-CR-161376; SP80-MSFC-2403) Avail: NTIS HC A10/MF A01 CSCL 22A

The need for a free flying science and applications space platform to host compatible long duration experiment groupings in Earth orbit is discussed. Experiment level information on strawman payload models is presented which serves to identify and quantify the requirements for the space platform system. A description data base on the strawman payload model is presented along with experiment level and group level summaries. Payloads identified in the strawman model include the disciplines of resources observations and environmental observations. A.W.H.

N80-18076*# General Dynamics/Convair, San Diego, Calif.
ORBITAL REFILL OF PROPULSION VEHICLE TANKAGE
F. Merino, J. Risberg, and M. Hill Feb. 1980 256 p
(Contract NAS3-21360)
(NASA-CR-159722; GDC-CRAD-80-001) Avail: NTIS HC A12/MF A01 CSCL 22A

Techniques for orbital refueling of space based vehicles were developed and experimental programs to verify these techniques were identified. Orbital refueling operations were developed for two cryogenic orbital transfer vehicles (OTV's) and an Earth storable low thrust liquid propellant vehicle. Refueling operations were performed assuming an orbiter tanker for near term missions and an orbital depot. Analyses were conducted using liquid hydrogen and N2O4. The influence of a pressurization system and acquisition device on operations was also considered. Analyses showed that vehicle refill operations will be more difficult with a cryogen than with an earth storable. The major elements of a successful refill with cryogens include tank prechill and fill. Propellant quantities expended for tank prechill appear to to insignificant. Techniques were identified to avoid loss of liquid or excessive tank pressures during refill. It was determined that refill operations will be similar whether or not an orbiter tanker or orbital depot is available. Modeling analyses were performed for prechill and fill tests to be conducted assuming the Spacelab as a test bed, and a 1/10 scale model OTV (with LN2 as a test fluid) as an experimental package. R.C.T.

N80-18077# European Space Operations Center, Darmstadt (West Germany). Operations Dept.
GEOS-2: REPORT ON THE FIRST SIX MONTHS OF ROUTINE OPERATIONS
Paris ESA Jun. 1979 69 p refs
Avail: NTIS HC A04/MF A01

The European Space Operations Center operational support and the onboard performance are summarized. Experiments performed daily are discussed and the satellite positions and maneuvers performed are described. Special experiment operations including balloon and rocket campaigns, (Porcupine, Substrom), a lithium release operation, and measurements along geomagnetic field lines are reported. An anomaly which occurred due to a failure in the solar array causing damage to some experiments is discussed. Author (ESA)

N80-18078# Royal Norwegian Council for Scientific and Industrial Research, Blindern. Space Activity Div.
SPACE ACTIVITY IN NORWAY, 1978
Oslo 1979 37 p refs Presented at 22nd COSPAR Plenary Meeting, Bangalore, India, May-June 1979
(SAD-80-T; ISBN-82-7224-026-2) Avail: NTIS HC A03/MF A01

The organization of space oriented activity in Norway over the year is discussed. The test facilities are described and programs for rocket and balloon sounding in conjunction with satellite projects are reported. Research in maritime satellite communication, search and rescue, satellite navigation, and geographical surveys are reviewed. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-18064*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ESTIMATING THE ANGULAR POSITION OF A MOVING DEEP SPACE VEHICLE USING TWO ROTATING TRACKING STATIONS
H. H. Tan *In its* The Deep Space Network 15 Feb. 1980 p 15-29 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N80-18059*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NETWORK FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network 15 Feb. 1980

p 1-4 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

N80-18061*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT
G. M. Rockwell *In its* The Deep Space Network 15 Feb. 1980 p 7-9 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

N80-18067*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FEASIBILITY STUDY OF A SPACECRAFT SURVEILLANCE SYSTEM
C. A. Greenhall *In its* The Deep Space Network 15 Feb. 1980 p 50-62 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 14B

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-18079# Naval Surface Weapons Center, White Oak, Md. Strategic Systems Dept.
MODIFLY: A MODULAR MULTI-DEGREE-OF-FREEDOM TRAJECTORY PROGRAM Final Report
John E. Holmes 1 Mar. 1979 127 p
(AD-A073901; NSWC/WOL/TR-78-59) Avail: NTIS HC A07/MF A01 CSCL 16/2

MODIFLY is a modular trajectory simulation computer program which was written so as to be effective, efficient, and easily modified. The program was designed primarily for the simulation of typical autonomous guided missiles in which roughly equal consideration is given to the simulations of the seekers, guidance, autopilot, controls, and aerodynamics. It was written in FORTRAN IV language for use on a CDC 6500 computer and uses overlay files and a library edit routine. GRA

N80-18080# Raytheon Co., Bedford, Mass. Missile Systems Div.
MODULAR DIGITAL MISSILE GUIDANCE Technical Report, 1 Jan. - 31 Dec. 1977
Frank J. Langley, A. J. Mannion, K. D. Laube, J. Demetrick, and D. S. Goldstein 14 Dec. 1979 288 p refs
(Contract N00014-75-C-0549)
(AD-A078808; BR-11344; ONR-CR-233-052-4) Avail: NTIS HC A13/MF A01 CSCL 17/7

A set of macromodular microcomputer specifications has been prepared to meet a wide range of missile guidance and control requirements. These specifications define the function performance and interface requirements of each microcomputer module, i.e., microprocessor, memory and input-output I/O interface for analog and serial digital I/O, such that device technology improvements can continually be accommodated within the bounds of module function performance and interface requirements. To ensure such flexibility in design, other alternative device technologies were reviewed and evaluated for the MIL-STD-4553A serial digital I/O interface and the spectrum analyzer module, viz: fiber-optic data link and charge-coupled device, (CCD), very-large-scale integration (VLSI) analyzer options. In addition, the requirements for universal microcomputer development systems were explored in order to support both medium-speed single-chip microprocessors and high-speed bit-slice emulators to preserve software commonality. Lastly, the compatibility of the Navy AN/UYK-30 microprocessor with the macromodular microcomputer family was investigated on the basis of throughput and electrical interface. In summary, this phase of the program has culminated in the generation of a practical set of microcomputer module specifications for multi-source procurement. GRA

N80-18081# M&S Computing, Inc., Huntsville, Ala.
THE DIGITAL AIR DEFENSE MISSILE SYSTEM SIMULATION TECHNICAL EFFORT Final Report, 14 May - 30 Sep. 1979
D. G. Ellenburg, M. K. Grounds, J. D. McCormick, T. C. Phillips, and E. G. Peters 30 Sep. 1979 13 p
(Contract DAAK40-79-D-0003)
(AD-A078814; REPT-79-057) Avail: NTIS HC A02/MF A01 CSCL 17/7

M and S Computing, Inc., has provided engineering and programming support to develop, modify, and utilize existing Guidance and Control simulation software, and has performed studies to determine system performance in assorted operational modes. This document summarizes the accomplishment of M and S Computing, Inc., for the past five months. The remainder of this document is divided into sections described below. Section 2 describes the digital area correlator model developed by M and S Computing, Inc. Section 3 describes the system analysis support provided by M and S Computing. GRA

N80-18082# Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.
BASELINE ACOUSTIC AND VIBRATION STUDY OF THE MINUTEMAN 2, INTEGRATED PROGRAM LAUNCH CONTROL CENTER, WS-133B (IP)
Nick A. Farinacci Jan. 1979 59 p refs
(AD-A075509; OEHL-79-10) Avail: NTIS HC A04/MF A01 CSCL 16/4

This report presents baseline acoustic and vibration data acquired in a Minuteman (2) (Integrated Program) Launch Control Center (WS-133B). No hazardous levels for exposures of up to 24 hour duration were found. Recommendations are provided to reduce the levels compatable with an environment suitable for long-duration crew alerts. GRA

N80-18083# Research Inst. of National Defence, Stockholm (Sweden).
KINETIC MODEL FOR A PURPOSE CARRYING TARGET FINDING AIR DEFENSE MISSILE (KINM) [KINEMATISK MODELL FOER SYFTBAERINGSMAALSOEKANDE LUFTVAARNSROBOT (KINM)]
Goeran Lyman and Inga Nordstroem Jul. 1979 45 p refs In SWEDISH
(FOA-C-20315-E3) Avail: NTIS HC A03/MF A01

A mathematical model for the trajectory of a purpose carrying target seeking air defense missile, launched against a moving target is described. The model is three dimensional, but the target can only have one arbitrary direction, with constant load factor. The kinetic trajectory of the missile is integrated from the thrust diagram and air resistance. The variation of air density and speed of sound with height was taken into account. The program was implemented for a DEC-10 computer. Author (ESA)

N80-18084# Research Inst. of National Defence, Stockholm (Sweden).
MISS DISTANCE WITH PURPOSE CARRYING CONTROL THROUGH COMMANDS FROM A GROUND STATION [BOMAVSTAAND VID SYFTBAARINGSSTYRNING MEDELST KOMMANDON FRAAN MARKSTATION]
Aake Assarsson Jul. 1979 25 p refs In SWEDISH
(FOA-C-20317-E3) Avail: NTIS HC A02/MF A01

The miss distance of a LV missile with steering commanded by a ground station was studied by computerized simulation of the last part of the trajectory which was assumed to be under internal control by the missile. Stochastic target and missile error angles were introduced as well as stochastic target maneuvering. It is concluded that further study is necessary to obtain acceptable miss distance results. Author (ESA)

N80-18085# Research Inst. of National Defence, Stockholm (Sweden).
SIMULATION OF LV MISSILE STEERING [SIMULERING AV LV-ROBOTSTYRNING MED UTSKJUTNING FRAAN FASTA LAVETTER]
Karl-Erik Olsson Jul. 1979 35 p refs In SWEDISH
(FOA-C-20318-E3) Avail: NTIS HC A03/MF A01

A computerized simulation of missile kinematic trajectories from fixed launchers was carried out using a continuous system modelling program. The study includes a description of kinematic analysis of missile steering and steering strategies for moving targets. The results are presented in form of diagrams and tables, showing the applications of the simulation method.Author (ESA)

N80-18060*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING ORBITER COMPLETION MISSION
R. L. Gillette *In its* The Deep Space Network 15 Feb. 1980 p 4-5 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 22A

N80-18227 Pacific Missile Test Center, Point Mugu, Calif.
THE VIBRATION RESPONSE OF THE PHOENIX MISSILE IN THE F-14 AIRCRAFT CAPTIVE-FLIGHT ENVIRONMENT
Marsha E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 139-150 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18228 Naval Weapons Center, China Lake, Calif.
SOME DYNAMIC RESPONSE ENVIRONMENTAL MEASUREMENTS OF VARIOUS TACTICAL WEAPONS
W. W. Parmenter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 151-158 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-18086# Committee on Science and Technology (U. S. House).
SPACE SHUTTLE 1980
Washington GPO 1980 599 p Status Rept. for Comm. on Sci. and Technol., 96th Congr., 2d Sess., Jan. 1980
(GPO-55-916) Avail: SOD HC

The space shuttle program cost, performance, and schedules were reviewed for 1980. As a result of NASA's financial and schedule assessment of the shuttle program for 1980, a need for a supplemental budget request was identified. A brief description of the space shuttle program is provided, and major issues are identified for the FY 1980 supplemental budget request, and the FY budget. F.O.S.

N80-18087*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION FOR THE DATA NOISING PROGRAM
M. T. Nguyen Jun. 1979 44 p
(Contract NAS9-15800)
(NASA-CR-160534; JSC-14807; LEC-13266) Avail: NTIS HC A03/MF A01 CSCL 05B

Problems in the Space Shuttle aerodynamic data that are expected to occur in the actual Orbital Flight Test (OFT) flight data are introduced. The user selects from 1 to 100 channels to be operated on by this program. For each selected channel number, the user may introduce up to three problems in the channel data: time skew, data noise in the frequency domain, and data-quantization. The output data is the input data plus the data for each selected channel number with NOISE selected by the program user. M.M.M.

N80-18088*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER SUBSYSTEM HARDWARE/SOFTWARE INTERACTION ANALYSIS. VOLUME 8: FORWARD REACTION CONTROL SYSTEM
Daniel D. Becker Jan. 1980 119 p refs
(NASA-TM-80959; JSC-14651-Vol-8) Avail: NTIS HC A06/MF A01 CSCL 09B

The results of the orbiter hardware/software interaction analysis for the AFT reaction control system are presented. The interaction between hardware failure modes and software are examined in order to identify associated issues and risks. All orbiter subsystems and interfacing program elements which interact with the orbiter computer flight software are analyzed. The failure modes identified in the subsystem/element failure mode and effects analysis are discussed. A.W.H.

N80-18089*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER SUBSYSTEM HARDWARE/SOFTWARE INTERACTION ANALYSIS. VOLUME 8: AFT REACTION CONTROL SYSTEM, PART 2
Daniel D. Becker Jan. 1980 136 p refs
(NASA-TM-80960; JSC-14651-Vol-8-Pt-2) Avail: NTIS HC A07/MF A01 CSCL 09B

The orbiter subsystems and interfacing program elements which interact with the orbiter computer flight software are analyzed. The failure modes identified in the subsystem/element failure mode and effects analysis are examined. Potential interaction with the software is examined through an evaluation of the software requirements. The analysis is restricted to flight software requirements and excludes utility/checkout software. The results of the hardware/software interaction analysis for the forward reaction control system are presented. A.W.H.

N80-18090*# Axiomatix, Los Angeles, Calif.
SHUTTLE GLOBAL POSITIONING (GPS) SYSTEM DESIGN STUDY Final Report
Peter Nilsen and Gaylord Huth 12 Feb. 1980 109 p refs
(Contract NAS9-15387)
(NASA-CR-160539; R8002-1) Avail: NTIS HC A06/MF A01 CSCL 22A

Investigations of certain aspects and problems of the shuttle global positioning system GPS, are presented. Included are: test philosophy and test outline; development of a phase slope specification for the shuttle GPS antenna; an investigation of the shuttle jamming vulnerability; and an expression for the GPS signal to noise density ratio for the thermal protection system. M.M.M.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N80-18091# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 3: TEST METHODS FOR RECORDER/REPRODUCER SYSTEMS AND MAGNETIC TAPE
1979 117 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075736; IRIG-118-79-Vol-3; IRIG-118-73-Rev) Avail: NTIS HC A06/MF A01 CSCL 09/6

Contents: Head Tests; Tape Speed Tests; Speed Variation and Timing Error Tests; Direct Record Systems Tests; FM Systems Tests. Appendixes: Application Notes for Magnetic Tape Recorder/Reproducer Testing; Magnetic Tape Test Procedures. GRA

N80-18092# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 4: TEST METHODS FOR DATA MULTIPLEX EQUIPMENT
1979 164 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075789; IRIG-118-79-Vol-4; IRIG-118-73-Rev) Avail: NTIS HC A08/MF A01 CSCL 09/6

Contents: Frequency Division Multiplex (FDM) Test Procedures; Time Division Multiplex (TDM) Systems; Subcarrier Oscillators; Bit Synchronizers; The Spectrum of an NRZ-PN

Sequence; Calculation of Bit Error Measurement Intervals; and Definitions and Suggested Circuits for Bit Synchronizer Testing.
GRA

N80-18093# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 1: END-TO-END TEST METHODS FOR TELEMETRY SYSTEMS
1979 93 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075735; IRIG-118-79-Vol-1; IRIG-118-73-Rev) Avail: NTIS HC A05/MF A01 CSCL 09/6

Contents: Solar Calibration; Test Methods for Transducer-Based System Calibrations; Alternate Solar Calibration Test Method; RF System Test Application Notes; Test for Receiver System Linearity.
GRA

N80-18094# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-range Instrumentation Group.
TEST METHODS FOR TELEMETRY SYSTEMS AND SUBSYSTEMS. VOLUME 2: TEST METHODS FOR TELEMETRY RF SUBSYSTEMS
1979 190 p refs Supersedes IRIG-118-73-Rev 4 Vol.
(AD-A075775; IRIG-118-79-Vol-2; IRIG-11873-Rev) Avail: NTIS HC A09/MF A01 CSCL 09/6

Contents: Test Procedures for Telemetry Antenna Systems; Test Procedures for Telemetry RF Preamplifiers; Test Procedures for Telemetry Multicouplers; Test Procedures for Telemetry Receivers; Test Procedures for Diversity Combiners; Appendixes: Intermodulation Products and Intercept Point; and Noise Figure Measurements.
GRA

N80-18072*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRELIMINARY TELEMETRY OPERATIONS EXPERIENCE WITH THE REAL-TIME COMBINER, 1 NOVEMBER 1978 TO 1 NOVEMBER 1979
N. K. Simon and C. Hoynes *In its* The Deep Space Network 15 Feb. 1980 p 90-96 ref (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09F

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-18095*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASCAP MODELLING COMPUTATIONS ON LARGE OPTICS SPACECRAFT IN GEOSYNCHRONOUS SUBSTORM ENVIRONMENTS
N. John Stevens and Carolyn K. Purvis 1980 20 p refs Presented at Soc. of Photo-Optical Instrumentation Engineers, Los Angeles Technical Symp., North Hollywood, Calif., 4-7 Feb. 1980
(NASA-TM-81395; E-305) Avail: NTIS HC A02/MF A01 CSCL 22B

The NASA Charging Analyzer Program (NASCAP) is used to evaluate qualitatively the possibility of such enhanced spacecraft contamination on a conceptual version of a large satellite. The evaluation is made by computing surface voltages on the satellite due to encounters with substorm environments and then computing charged particle trajectories in the electric fields around the satellite. Particular attention is paid to the possibility of contaminants reaching a mirror surface inside a dielectric tube because this mirror represents a shielded optical surface in the satellite model used. Deposition of low energy charged particles from other parts of the spacecraft onto the mirror was found to be possible in the assumed moderate substorm environment condition. In the assumed severe substorm environment condition, however, voltage build up on the inside and edges of the dielectric tube in which the mirror is located prevents contaminants from reaching the mirror surface.
J.M.S.

N80-18096# TRW, Inc., Redondo Beach, Calif.
PHASE CHANGE/HEAT STORAGE MATERIALS DATA COMPILATION Final Report, Aug. 1978 - Jan. 1979
V. R. Hunter and R. F. Block Jun. 1979 52 p refs Prepared in cooperation with Honeywell, Inc., St. Petersburg, Fla.
(Contract F33615-78-C-5081; AF Proj. 2100)
(AD-A076414; AFML-TR-79-4078) Avail: NTIS HC A04/MF A01 CSCL 20/5

A survey of available phase change heat storage materials for space temperature control applications are surveyed. A list of thirty one low-to-medium temperature (100 to 800 F) phase change storage materials are recommended as prime candidates for limiting component temperature excursions during a laser threat. Appendices are provided that include a data compilation of over 200 phase change heat storage materials, a list of data references, a phase change material bibliography and more descriptive information on the prime heat storage material candidates.
GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N80-18097* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PRESSURE LIMITING PROPELLANT ACTUATING SYSTEM Patent
Paul B. Reese (Rockwell International Corp., Downey, Calif.) and David W. Murphy, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 15 Jan. 1980 4 p Filed 4 Aug. 1978 Supersedes N78-31162 (16 - 22, p 2906)
(NASA-Case-MSC-18179-1; US-Patent-4,183,217;
US-Patent-Appl-SN-931218; US-Patent-Class-60-632) Avail: US Patent and Trademark Office CSCL 21H

A pressure limiting propellant activating system for simultaneously limiting the output force while maintaining a constant output pressure from the combustion chamber is described. The propellant actuated system includes an outer barrel, outer housing and a combustion chamber. A main piston is movable in the barrel housing when gas pressure is developed in the combustion chamber. A relief piston is concentrically mounted and fixedly movable with the main piston when gas pressure is exerted from the combustion. A relief piston has a force-activated separation mechanism for limiting the output force while simultaneously maintaining constant output pressure on the main piston from the combustion chamber.
Official Gazette of The U.S. Patent and Trademark Office

N80-18098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ECONOMIC ANALYSIS OF THE DESIGN AND FABRICATION OF A SPACE QUALIFIED POWER SYSTEM

Gregory Ruselowski Jan. 1980 25 p refs
(NASA-TM-81418; E-339) Avail: NTIS HC A02/MF A01 CSCL 10B

An economic analysis was performed to determine the cost of the design and fabrication of a low Earth orbit, 2 kW photovoltaic/battery, space qualified power system. A commercially available computer program called PRICE (programmed review of information for costing and evaluation) was used to conduct the analysis. The sensitivity of the various cost factors to the assumptions used is discussed. Total cost of the power system was found to be $2.46 million with the solar array accounting for 70.5%. Using the assumption that the prototype becomes the flight system, 77.3% of the total cost is associated with manufacturing. Results will be used to establish whether the cost of space qualified hardware can be reduced by the incorporation of commercial design, fabrication, and quality assurance methods. J.M.S.

N80-18099# Naval Surface Weapons Center, Dahlgren, Va.
COMPARISON OF ABLATIVE MATERIALS IN A SOLID ROCKET MOTOR FLOW FIELD
J. B. Henderson, L. P. Anderson, and G. R. Moore Aug. 1979 39 p Sponsored in part by Naval Sea Systems Command
(AD-A075507; NSWC/TR-79-218) Avail: NTIS HC A03/MF A01 CSCL 11/7

Seven different ablative materials have been tested behind Thiokol TOMAHAWK rocket motors. The maximum erosion, erosion patterns, and the mass loss of the samples have been determined from these tests. In addition, time-dependent temperature profiles were measured in four of the test samples during firing. From these data, local ablation rates for the materials were determined. GRA

N80-18230 Hercules, Inc., Magna, Utah.
CALCULATION OF ATTACH POINT LOADS DUE TO POSSIBLE COMBUSTION INSTABILITY IN THE SPACE SHUTTLE SOLID ROCKET BOOSTERS
F. R. Jensen and D. T. Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 171-174 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-18100# University of Southern California, Los Angeles. Dept. of Chemistry.
ORGANOSILICON CHEMISTRY Final Report, 1 Oct. 1976 - 30 Sep. 1979
William P. Weber Sep. 1979 68 p refs
(Grant AF-AFOSR-3123-77)
(AD-A078293; AFOSR-79-1233TR) Avail: NTIS HC A04/MF A01 CSCL 07/3

The following studies are summarized: (a) several aspects of the chemistry of polysilane-polysulfides (b) the photochemical generation of silicon-oxygen doubly bonded intermediates and the study of the insertion of these intermediates into Si-O single bonds of siloxanes, (c) novel reactions of silylenes, (d) the mass spectral fragmentation patterns of several classes of aryl substituted disiloxanes, (e) generation of dichlorocarbene under phase transfer catalysis conditions, and (f) gas phase vacuum pyrolysis of several five membered heterocyclic-1,2-butadrenes. GRA

N80-18101# National Bureau of Standards, Washington, D.C. Chemical and Biodegradation Processes Group.
APPLICATION OF A GRAPHITE FURNACE ATOMIC ABSORPTION DETECTOR AUTOMATICALLY COUPLED TO HPLC FOR SPECIATION OF METAL-CONTAINING MACROMOLECULES Interim Report
E. J. Parks, F. E. Brinckman, and W. R. Blair May 1979 31 p refs Presented at the Intern. Symp. on Column Liquid Chromatography, Boston, 7-10 May 1979 Submitted for publication
(NR Proj. 356-689)
(AD-A077321) Avail: NTIS HC A03/MF A01 CSCL 07/3

High pressure liquid chormatography (HPLC) coupled with graphite furnace atomic absorption (GFAA) is capable of sensitive, nearly non-destructive, element-specific separation and detection of a wide range of molecular species containing metals or metalloids. Applications of HPLC-GFAA techniques are discussed, including size exclusion chromatography (SEC) for the analysis of experimental organometallic polymers containing chemically bonded biocidal organotin moieties, and reverse bonded phase (RBP) chromatogrphy for analysis of novel organotin silicates In conjunction with variably sensitive optical RI/UV detection, GFAA demonstrates separation of the polymers into a least two tin-containing fractions of widely different molecular weight (MW). The relative proportions of high and low MW fractions have important implication with respect to performance specifications for these and similar controlled release materials. Tin-specific and silicon-specific analysis of an organotin silicate demonstrates co-elution of species containing each element. Future off/online Si29 and Sn119 FT-NMR will demonstrate whether each element is bonded to the same molecular species. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-18102 Duke Univ., Durham, N. C.
PLASTIC ANALYSIS OF METAL-MATRIX COMPOSITE LAMINATES Ph.D. Thesis
Yehia Ahmed Bahei-El-Din 1979 273 p
Avail: Univ. Microfilms Order No. 8003614

The development of phenomenological materials models for elastic-plastic fibrous composites is described with emphasis on a continuum model which represents the mechanical properties of the constituents and the essential features of their mutual constraints. Such a material model is developed, and constitutive equations describing hardening and flow rules are derived. Evaluation of the model is made in regard to the application of fibrous metal-matrix composites in laminated plates. The capability of the material model and the finite element method in describing the behavior of composite structures was demonstrated in evaluating both the overall response and the plastic yielding of laminated plates with discontinuities, such as holes and notches. Dissert. Abstr.

N80-18103*# Lockheed-California Co., Burbank.
ADVANCED COMPOSITE AILERON FOR L-1011 TRANSPORT AIRCRAFT Quarterly Technical Report, 22 Dec. 1973 - 24 Mar. 1978
14 Apr. 1978 54 p ref
(Contract NAS1-15069)
(NASA-CR-162863; LR-28559; DLR-003; QTR-2) Avail: NTIS HC A04/MF A01 CSCL 11D

Design and evaluation of alternate concepts for the major subcomponents of the advanced composite aileron (ACA) was completed. From this array of subcomponents, aileron assemblies were formulated and evaluated. Based on these analyses a multirib assembly with graphite tape/syntactic core covers, a graphite tape front spar, and a graphite fabric rib was selected for development. A weight savings of 29.1 percent (40.8 pounds per aileron) is predicted. Engineering cost analyses indicate that the production cost of the ACA will be 7.3 percent less than the current aluminum aileron. Fabrication, machining, and testing of the material evaluation specimens for the resin screening program was completed. The test results lead to the selection of Narmco 5208 resin for the ACA. Other activities completed include: the detailed design of the ACA, construction of a three dimensional finite element model for structural analysis, and formulation of detail plans for material verification and process development. R.E.S.

N80-18104*# Lockheed-California Co., Burbank.
ADVANCED MANUFACTURING DEVELOPMENT OF A COMPOSITE EMPENNAGE COMPONENT FOR L-1011 AIRCRAFT Quarterly Technical Report, 1 Jan. 1978 - 31 Mar. 1978

14 Apr. 1978 130 p
(Contract NAS1-14000)
(NASA-CR-162862; LR-28573; DLR-003; QTR-9) Avail: NTIS HC A07/MF A01 CSCL 11D

Tooling concepts were developed which would permit co-couring of the hat stiffeners to the skin to form the cover assembly in a single autoclave cycle. These tooling concepts include the use of solid rubber mandrels, foam mandrels, and formed elastometric bladders. A simplification of the root end design of the cover hat stiffeners was accomplished in order to facilitate fabrication. The conversion of the 3D NASTRAN model from level 15 to level 16 was completed and a successful check run accomplished. A detailed analysis of the thermal load requirement for the environmental chambers was carried out. Based on the thermal analysis, best function requirements, load inputs and ease of access, a system involving four chambers, two for the covers containing 6 and 4 specimens, respectively, and two for the spares containing 6 and 4 specimens, respectively, evolved. R.E.S.

N80-18105*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SMALL-SCALE TEST FOR FIBER RELEASE FROM CARBON COMPOSITES
W. J. Gilwee, Jr. and R. H. Fish Feb. 1980 9 p refs Presented at Conf. on Advanced Composites, Special Topics, El Segundo, Calif., 4-6 Dec. 1979
(NASA-TM-81179; A-7962) Avail: NTIS HC A02/MF A01 CSCL 11D

A test method was developed to determine relative fiber loss from pyrolyzed composites with different resins and fiber construction. Eleven composites consisting of woven and unwoven carbon fiber reinforcement and different resins were subjected to the burn and impact test device. The composites made with undirectional tape had higher fiber loss than those with woven fabric. Also, the fiber loss was inversely proportional to the char yield of the resin. K.L.

N80-18106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF COMPOSITE MATERIALS TO TURBOFAN ENGINE FAN EXIT GUIDE VANES
G. T. Smith 1980 19 p refs Presented at 35th Ann. Conf. of the Reinforced Plastics/Composite Inst., New Orleans, 4-8 Feb. 1980; sponsored by Soc. of Plastics Industries
(NASA-TM-81432; E-356) Avail: NTIS HC A02/MF A01 CSCL 11D

A program was conducted by NASA with the JT9D engine manufacturer to develop a lightweight, cost effective, composite material fan exit guide vane design having satisfactory structural durability for commerical engine use. Based on the results of a previous company supported program, eight graphite/epoxy and graphite-glass/epoxy guide vane designs were evaluated and four were selected for fabrication and testing. Two commercial fabricators each fabricated 13 vanes. Fatigue tests were used to qualify the selected design configurations under nominally dry, 38 C (100 F) and fully wet and 60 C (140 F) environmental conditions. Cost estimates for a production rate of 1000 vanes per month ranged from 1.7 to 2.6 times the cost of an all aluminum vane. This cost is 50 to 80 percent less than the initial program target cost ratio which was 3 times the cost of an aluminum vane. Application to the JT9D commercial engine is projected to provide a weight savings of 236 N (53 lb) per engine. Author

N80-18107*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIRE TEST METHOD FOR GRAPHITE FIBER REINFORCED PLASTICS
Kenneth J. Bowles 1980 13 p refs Presented at 5th Intern. Conf. on Fire Safety, Millbrae, Calif., 14-18 Jan. 1980
(NASA-TM-81436; E-360) Avail: NTIS HC A02/MF A01 CSCL 11D

A potential problem in the use of graphite fiber reinforced resin matrix composites is the dispersal of graphite fibers during accidential fires. Airborne, electrically conductive fibers originating from the burning composites could enter and cause shorting in electrical equipment located in surrounding areas. A test method for assessing the burning characteristics of graphite fiber reinforced composites and the effectiveness of the composites in retaining the graphite fibers has been developed. The method utilizes a modified rate of heat release apparatus. The equipment and the testing procedure are described. The application of the test method to the assessment of composite materials is illustrated for two resin matrix/graphite composite systems. A.R.H.

N80-18108*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE POTENTIAL FOR DAMAGE FROM THE ACCIDENTAL RELEASE OF CONDUCTIVE CARBON FIBERS FROM BURNING COMPOSITES
Vernon L. Bell Apr. 1980 23 p refs Proposed for presentation at the AGARD Structures and Materials Panel Specialist's Meeting of Effect of Service Environment on Composite Materials, Athens, Greece, 16 Apr. 1980
(NASA-TM-80213) Avail: NTIS HC A02/MF A01 CSCL 11D

The potential damage to electrical equipment caused by the release of carbon fibers from burning commercial airliners is assessed in terms of annual expected costs and maximum losses at low probabilities of occurrence. A materials research program to provide alternate or modified composite materials for aircraft structures is reviewed. K.L.

N80-18109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITE COMPONENTS ON COMMERCIAL AIRCRAFT
H. Benson Dexter Mar. 1980 24 p refs To be presented at the AGARD Specialist Meeting on Effect of Service Environ. on Composite Mater., Athens, 13-18 Apr. 1980
(NASA-TM-80231) Avail: NTIS HC A02/MF A01 CSCL 11D

Commercial aircraft manufacturers are making production commitments to composite structure for future aircraft and modifications to current production aircraft. Flight service programs with advanced composites sponsored by NASA during the past 10 years are described. Approximately 2.5 million total composite component flight hours have been accumulated since 1970 on both commercial transports and helicopters. Design concepts with significant mass savings were developed, appropriate inspection and maintenance procedures were established, and satisfactory service was achieved for the various composite components. A major NASA/U.S. industry technology program to reduce fuel consumption of commercial transport aircraft through the use of advanced composites was undertaken. Ground and flight environmental effects on the composite materials used in the flight service programs supplement the flight service evaluation. A.R.H.

N80-18110# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.
HYGROTHERMAL RESPONSE OF POLYMER MATRIX COMPOSITE MATERIALS Final Report, 9 Feb. 1976 - 8 Feb. 1979
Donald F. Adams and David E. Walrath Sep. 1979 35 p refs
(Grant DAAG29-76-G-0163; DAAG29-78-G-0053)
(AD-A076623; UWME-DR-901-102-1; ARO-13323.6-MSX) Avail: NTIS HC A03/MF A01 CSCL 11/4

A two-dimensional, generalized plane strain, finite element analysis of the stress states in the individual fibers and surrounding matrix of a unidirectionally reinforced composite material was developed. The fibers are modeled as elastic but anisotropic; the matrix is modeled as isotropic, but elastoplastic. Thermal and moisture absorption histories as well as temperature - and moisture-dependent material properties are included. A complete finite element computer program, an associated plot package, and extensive numerical results are available. Experimental work was conducted using unreinforced (neat resin), castings of Hercules 3501-6 epoxy matrix, as well as AS/3501-6 graphite/epoxy matrix, and S2/3501-6 glass/epoxy unidirectional composites. Axial and transverse tensile tests as well as torsional shear tests were performed, under various temperatures and moisture conditions. Experimental results and comparisons with micromechanics predictions are summarized, with references given to various conference and journal publications for detailed information. GRA

N80-18111# Connecticut Univ., Storrs. Dept. of Mechanical Engineering.
WEAR OF HOMOGENEOUS AND COMPOSITE MATERIALS UNDER CONDITIONS OF REPEATED NORMAL AND SLIDING IMPACT Final Report, 30 Jun. 1976 - 31 Aug. 1979
Stephen Rice and Roman Solecki 1979 36 p refs
(Grant AF-AFOSR-3087-76; AF Proj. 2307)
(AD-A078429; AFOSR-79-1241TR) Avail: NTIS
HC A03/MF A01 CSCL 20/11

This report describes experimental and analytical investigations in the area of wear of materials under repetitive compound impact. A reciprocating apparatus which provides controlled, repeatable, measureable impulsive loads between specimen and counterface has been employed in wear testing. Specimen materials in previous experimentation include polymers, composites, and several alloys. That reported herein focuses upon titanium alloys, metallic composites, and copper-chromium alloys. The formation of subsurface zones occurring in impact wear appears to be significant. Correlations between subsurface strain gradients and wear have been demonstrated. These subsurface plastic deformations are dependent upon macroscopic 'solid contact' conditions imposed during impact. Temperatures occasioned at and near the wear interface are shown locally to each level of 800C for test conditions explored. Void and crack formation in the substrate is occasionally observed, but not nearly to the extent reported for materials under conditions of sliding wear. Analytical investigations are directed toward determination of the states of stress in material specimens undergoing controlled repetitive impact. Results are derived from the equations of the linear theory of elasticity applied to a finite cylinder impacting a rough, rigid surface. GRA

N80-18112# Daedalean Associates, Inc., Woodbine, Md.
ENGINEERING FEASIBILITY OF INTERNAL FRICTION DAMPING AS A NONDESTRUCTIVE EVALUATION TECHNIQUE FOR SYNTHETIC ROPES Final Report
David C. Fresch, Larry L. Yeager, and A. P. Thiruvengadam
28 Feb. 1979 229 p refs
(Contract DOT-CG-828271-A)
(AD-A078461; USCG-D-51-79) Avail: NTIS
HC A11/MF A01 CSCL 11/5

This report discusses the technical feasibility of applying an internal friction damping, nondestructive evaluation technique for synthetic ropes. Applications for synthetic ropes include mooring lines, towing hawsers and lines for single point moorings (SPM) in deep water ports (DWP). The theory of internal friction damping is presented as it has been historically applied to metallic materials. The report then discusses the methodology for application of the internal friction damping technique to synthetic rope material and construction. The experimental apparatus and specific laboratory technique as applied to six inch and eight inch circumference rope is next discussed in detail. The report then discusses the experimental results and relates the test results to feasibility of employing the test technique as a guideline device for rope deterioration/performance. The report also relates this discussion to characteristics of the ropes tested under both wet and dry conditions. The experimental results section concludes with a comparison of the effect of the internal friction damping for various synthetic rope failure mechanisms. GRA

N80-18113# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
FINAL EVALUATION OF RAIN EROSION ON SLED TEST RESULTS AT MACH 3.7 TO 5.0 FOR SLIP-CAST FUSED SILICA RADOME STRUCTURES
K. N. Letson and William G. Burleson 6 Mar. 1979 63 p refs
(AD-A077348; DRSMI-T-79-42) Avail: NTIS
HC A04/MF A01 CSCL 11/2

This report contains a summary of rain erosion results obtained for high-purity slip-cast fused silica (SCFS) models on sleds at Holloman Air Force Base, New Mexico. This effort, which was initiated to evaluate the rain erosion behavior of SCFS as a function of velocity and angle of incidence was completed with good correlation of results. The tests were performed in artificial rain at average velocities between 1270 and 1740 m/sec (Mach 3.7 and 5.0). Right circular cone models having semivertex angles of 15, 19, 22.5, 25, 27.5, and 30 degrees were tested. A special test vehicle and sample design were utilized to avoid sled vibration-induced failures that are common to small samples of brittle ceramics at velocities near Mach 5. A unique feature of the sled test vehicle is its capability of testing seven cone frusta, thereby simulating actual radome forebody shapes. The sample design and special mounting technique resulted in obtaining correlatable erosion data which were free of spurious mass losses caused by sample fracture and edge effects. Because SCFS has low fracture toughness and relatively poor rain erosion resistance under severe conditions, other candidate ceramic and plastic radome materials were tested concurrently in the interest of finding a tougher structure. However only those results for SCFS are presented in this report. GRA

N80-18114# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Centrale.
INFLUENCE OF THE ORIENTATION AND THE CROSSING OF FIBERS ON THE RUPTURING OF NOTCHED CARBON FIBER/EPOXY COMPOSITE MATERIALS Final Report [INFLUENCE DE L'ORIENTATION ET DU CROISEMENT DES FIBRES SUR LA RUPTURE DES COMPOSITES FIBRES DE CARBONE-EPOXYDE ENTAILLES]
C. Bathias 29 Aug. 1978 43 p refs In FRENCH
(Contract DGRST-76-7-1017)
(PV-38.022) Avail: NTIS HC A03/MF A01

Notched specimens as well as specimens containing holes were subjected to traction loads to rupture in order to determine the influence of fiber orientation and notch or hole sensitivity on fracture strength. The mathematical tools used in the analysis along with a radiographic technique for characterizing notch damage are discussed. Results demonstrate that the presence of notches or holes equally weaken this type of composite. Crossing the reinforcing fibers at 45 deg gives better results than at 30 deg. A study of the fracture mechanisms, based on a finite element layer analysis of the damaged zone, indicates that the 'R curve' can be used to predict the fracture strength of composite plates. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N80-18115 Indiana Univ., Bloomington.
HIGH-PRECISION MASS SPECTROMETRIC HYDROGEN ISOTOPE RATIO MEASUREMENTS Ph.D. Thesis
David William Peterson 1979 236 p
Avail: Univ. Microfilms Order No. 8000717

The analytical capabilities of mass spectrometric ion-current measurement systems are described on both a theoretical and a practical basis. From the theoretical standpoint, a signal-to-noise ratio (S/N) model that evaluated the fundamental sources of noise present in ion-current measurement systems was developed. Use of this model accurately predicted the performance (precision) for ion-current ratio measurements made by two isotope ratio mass spectrometers, one designed for carbon isotopic measurements, and the other designed for hydrogen isotopic measurements. For the hydrogen isotope ratio mass spectrometer, the precision of a differential ratio measurement was calculated by use of the S/N model (0.26 0/00) and shown to be in good agreement with the measured precision (0.24 0/00). Dissert. Abstr.

N80-18116 Virginia Univ., Charlottesville.
INELASTIC ELECTRON TUNNELING SPECTROSCOPY OF UV IRRADIATED MOLECULES Ph.D. Thesis
James Michael Clark 1979 191 p

Avail: Univ. Microfilms Order No. 8002512

Tunneling spectroscopy was applied to the study of molecular radiation damage. Purine and pyrimidine nucleotides, small peptides and substituted benzene ring compounds in monolayer coverage were irradiated with ultraviolet radiation under ultrahigh vacuum conditions. Damage to the molecules is manifested by a loss of intensity in the vibrational structure due to bond weakening or bond rupture and by an enhancement in intensity as new radiation products are formed. In a comprehensive study of nucleic acid constituents, IETS was capable of detecting subtle structural variations among compounds containing the same purine or pyrimidine base as well as distinguishing among compounds containing different bases. Spectra which can differentiate among derivatives of the purine base adenine were produced by carefully measuring the spectral region below 600 1/cm for each derivative. Dissert. Abstr.

N80-18117 Massachusetts Univ., Amherst.
FUNCTIONAL GROUP SELECTIVE HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC STATIONARY PHASES Ph.D. Thesis
Thomas Henry Mourey 1979 224 p
Avail: Univ. Microfilms Order No. 8004967

Functional group selectivity has been incorporated into high performance liquid chromatographic stationary phases by taking advantage of the chemistry, electronic character, and physical-chemical properties of individual functional groups present in the solute molecules. These phases were manufactured by synthesizing novel orgarohalosilanes which possess reactive functionalities. Dissert. Abstr.

N80-18118 Illinois Univ. at Urbana-Champaign.
ELECTRON PARAMAGNETIC RESONANCE STUDIES OF LOW SYMMETRY NICKEL(I) AND MOLYBDENUM (V) COMPLEXES. PART 1: COMPUTER SIMULATION OF ELECTRON PARAMAGNETIC RESONANCE SPECTRA. PART 2: ELECTRON PARAMAGNETIC RESONANCE STUDIES OF NICKEL(I) TRIPHENYLPHOSPHINE COMPLEXES. PART 3: ELECTRON PARAMAGNETIC RESONANCE STUDIES OF A MOLYBDENUM(V) THIOCYANATE COMPLEX Ph.D. Thesis
Mark Joseph Nilges 1979 201 p
Avail: Univ. Microfilms Order No. 8004241

Part 1 describes computer programs that are used to simulate single crystal and polycrystalline electronic paramagnetic resonance (EPR) spectra for S=1/2 systems with nuclear hyperfine and quadrupole interactions. The programs are applicable to low symmetry complexes and allow for the noncoincidence of different EPR tensors. Part 2 describes the successful preparation and EPR spectra of single crystals of Ni. The unusual spectral features in the EPR spectra of the complexes are explained in terms of a halogen nuclear quadrupole interaction which is competitive with the halogen superhyperfine interaction. Part 3 describes the EPR spectra of Mo-95 and Mo-97 doped single crystals of TPA2NbO(SCN)5. Dissert. Abstr.

N80-18119 Cornell Univ., Ithaca, N. Y.
THREE STUDIES IN THE ELECTRONIC AND VIBRATIONAL STRUCTURE OF POLYATOMIC MOLECULES. 1: THE THERMAL LENSING SPECTROMETER AND THE LOCAL MODE MODEL OF VIBRATIONAL OVERTONE SPECTRA. 2: CALCULATIONS OF SECOND ORDER HYPERPOLARIZABILITIES. 3: THE MOLECULAR STRUCTURE OF THE BENZYL RADICAL AND ITS IONS AND A PROGRAM FOR NORMAL MODE ANALYSIS Ph.D. Thesis
James Albert Morrell 1979 251 p
Avail: Univ. Microfilms Order No. 8003957

The thermal lensing absorption spectrometer was used to characteristize the C-H stretching overtones in several aromatic and aliphatic molecules. The spectra derived from different types of C-H bonds are clearly resolved, and spectral shifts are seen which arise from intermolecular perturbations of the force constants of the C-H oscillators. This absorption spectrometer was used to develop and verify the local mode model of overtone absorption spectra. In addition, the hyperpolarizability of several substituted organic systems was computed. It was found that only one charge transfer state accounts for the bulk of the nonlinearity of p-nitroaniline. A structural determination of the benzyl radical and ions revealed that the radical and the anion are planar, while the cation has C sub 3 symmetry with the CH2 group slightly out of plane. A program for the calculation of the normal modes of vibrations and harmonic vibrational energies of small molecular systems is given. Dissert. Abstr.

N80-18120 Wisconsin Univ. - Madison.
A MASS POINT LOCALIZED KINETIC THEORY OF FLUIDS Ph.D. Thesis
Richard Lee Hansen 1979 149 p
Avail: Univ. Microfilms Order No. 8001142

A kinetic theory of molecules with internal degrees of freedom was developed which recognizes the size and structure of the molecules involved. This was accomplished by localizing the kinetic quantities for a given mass point at the position of that mass point. The kinetic theory represents a generalization of an earlier theory to include more general potentials of intermolecular and intramolecular interaction. It is shown for the mass point localized kinetic theory that a symmetric pressure tensor results. It is also shown that an antisymmetric part to the pressure tensor is not necessary for the rotational relaxation of a rotationally excited system. A model calculation is carried out for a polymeric solution in which hydrodynamic interaction forces are included. The system considered for the model calculation is composed of a single species of polymer, modeled as an asymmetric dumbbell, in a single structureless solvent. Dissert. Abstr.

N80-18121 Illinois Univ. at Urbana-Champaign.
CHEMICAL AND PHYSICAL CHARACTERIZATION OF ENVIRONMENTAL POLLUTANTS Ph.D. Thesis
Mary Myers Tucker 1979 156 p
Avail: Univ. Microfilms Order No. 8004290

A single method for the speciation of inorganic and organic mercury in natural water samples was developed. The technique specifically reduces inorganic mercury, Hg(2+), to elemental mercury by simple alkaline sodium borohydride reduction, followed by cold vapor atomic absorption detection. Total mercury, Hg(2+) and RHgX, is similarly determined following decomposition of the organic mercury by ultraviolet light. A simple particle leaching technique was developed to obtain information about physical characteristics and speciation of particle surfaces. Analysis of cumulatively collected leachate provides integral leaching curves; whereas, analysis of incrementally collected leachate provides differential leaching curves. These curves yield complementary information about the physical availability of the elements to the environment via the leaching process. Dissert. Abstr.

N80-18122 Massachusetts Univ., Amherst.
APPLICATIONS OF OPEN TUBULAR COLUMNS TO THE GAS CHROMATOGRAPHY OF VOLATILE METAL COMPLEXES Ph.D. Thesis
Therese Phyllis Tetu 1979 289 p
Avail: Univ. Microfilms Order No. 8004995

The chromatographic behavior of volatile metal complexes on a variety of open tubular columns was investigated. Primary interest was focussed on the tetradentate beta-ketoamine complexes of Cu(II) and Ni(II). Extensions of this work included an investigation of the behavior of several chromium (III) beta-diketonates and organometallics on these columns. Initial investigations were performed using stainless steel porous layer open tubular (PLOT) columns. The viability of glass PLOT columns for metal complex GC was also investigated. The principle column for these investigations was a non-polar OV101 PLOT column. The use of a deactivated substrate in ths case allowed the successful elution of Cu(II) and Ni(II) tetradentate beta-ketoamines possessed of various degrees thermal and chromatographic stability. Dissert. Abstr.

N80-18123 Pittsburgh Univ., Pa.
SEVERAL APPLICATIONS OF NONDISPERSIVE CONTINUUM SOURCE ATOMIC FLUORESCENCE SPECTROMETRY Ph.D. Thesis
Frank Lipari 1979 155 p
Avail: Univ. Microfilms Order No. 8004867

A wavelength modulated spectrometer and a continuum source atomic fluorescence system for the simultaneous multielement determination of elements that form volatile metal hydrides are discussed. Spectral selectivity, in both cases, is achieved by

the use of bandpass interference filters. The wavelength modulated spectrometer has comparable sensitivity to atomic absorption spectrometry (AAS) and was applied with good results in trace metal determinations in pooled blood serum. The atomic fluorescence system also has sensitivity comparable to AAS and was utilized in The simultaneous multielement mode for As, Sb, and Ge determinations in NBS Low Allow Steel samples. The main advantages of these instruments are that they are low cost, simple, easy to operate, free of spectral interference, and applicable to analyses in a wide variety of matrices.
Dissert. Abstr.

N80-18124 Massachusetts Univ., Amherst.
THE ANALYSIS AND CHARACTERIZATION OF THE URETHANE FUNCTIONAL GROUP VIA FUSION REACTION GAS CHROMATOGRAPHY Ph.D. Thesis
David George Gibian 1979 120 p
Avail: Univ. Microfilms Order No. 8004927

Fusion reaction gas chromatography was applied to the analysis and characterization of urethanes and polurethanes. It was found to be a rapid and accurate means of assaying and characterizing compounds containing the urethane functional group. The advantages of fusion reaction gas chromatography are that a one piece apparatus may be used, ensuring identical conditions for all samples. Reactions are made to go to completion. Only milligram amounts of sample are required, and the sample need not be volatile. Each component of a mixture containing the same functional group can be determined, in contrast to standard functional group methods which only give total functional group present. Matrix effects are removed and undesirable side reactions eliminated. Dissert. Abstr.

N80-18125 Massachusetts Univ., Amherst.
THE APPLICATION OF CHROMATOGRAPHY AND ANCILLARY TECHNIQUES TO THE CHARACTERIZATION OF SHALE OIL/OIL SHALE COMPOUND CLASSES AND OF ORGANOMETALLICS Ph.D. Thesis
Frank Patrick DiSanzo 1979 203 p
Avail: Univ. Microfilms Order No. 8004916

Chromatography and Ancillary techniques (specific detectors and mass spectrometry) were applied to the characterization of shale oil and oil shale compound classes and of organometallics. An inexpensive and simple preparative low pressure high performance liquid chromatographic scheme was developed for shale oil hydrocarbon analysis. Activated silica and silver nitrate impregnated 32-63 micron silica was employed for the isolation of alkanes, alkenes, and aromatics. Evidence for the presence of prist-1-ene in the alkene fraction is presented. Application of on-line reactors to aid in the discrimination between various classes of hydrocarbons is also described. Dissert. Abstr.

N80-18126 North Carolina Univ. at Chapel Hill.
SOME APPLICATIONS OF NEGATIVE ION MASS SPECTROMETRY Ph.D. Thesis
Kenneth Louis Busch 1979 255 p
Avail: Univ. Microfilms Order No. 8005018

Methane or a mixture of methane and oxygen were used as moderator gases at 1 to 2 torr in a chemical ionization mass spectrometer to produce gas enhanced negative ion mass spectra. Negative ion mass spectra were compared with electron impact and methane positive chemical ionization mass spectra for organophosphorus pesticides. Polychlorinated aromatic hydrocarbons, nitriles, and organometallic compounds were also investigated. Methane enhanced negative ion mass spectrometry proved to be useful by virtue of abundant ions reflecting molecular weight, reduced fragmentations, and for those molecules with several electrophores, a sensitivity much greater than the positive ion methods.
Dissert. Abstr.

N80-18127 Princeton Univ., N. J.
APPLICATIONS OF COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) Ph.D. Thesis
Gabriel Laufer 1978 148 p
Avail: Univ. Microfilms Order No. 8003791

New Coherent Anti-Stokes Raman Spectroscopy (CARS) techniques and their application to gas diagnostics and surface spectroscopy are presented. In the first experiment, hollow waveguides are shown to enhance CARS by two orders of magnitude for low pressure gases. Theoretical and experimental comparisons of signals generated by tight focusing in a cell with those generated in a hollow waveguide are presented. These arguments show that for low pressures, enhancements are on the order of the square of the waveguide length to the confocal beam parmeter ratio. In the second experiment, a new crossed beam CARS configuration is studied. This crossed beam configuration produces an angularly separated CARS spectrum, eliminating the need for a spectrometer. Dissert. Abstr.

N80-18128*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
COMBUSTION STABILITY WITH BAFFLES, ABSORBERS AND VELOCITY SENSITIVE COMBUSTION Final Report, Dec. 1969 - Feb. 1980
C. E. Mitchell Feb. 1980 9 p refs
(Grant NGR-06-002-095)
(NASA-CR-162803) Avail: NTIS HC A02/MF A01 CSCL 21B

Analytical and computational techniques were developed to predict the stability behavior of liquid propellant rocket combustors using damping devices such as acoustic liners, slot absorbers, and injector face baffles. Models were developed to determine the frequency and decay rate of combustor oscillations, the spatial and temporal pressure waveforms, and the stability limits in terms of combustion response model parameters. K.L.

N80-18129# Naval Research Lab., Washington, D. C.
CATALYSTS FOR THE OXIDATION OF CARBON MONOXIDE AT LOW TEMPERATURES Interim Report
J. K. Musick and F. W. Williams Nov. 1979 28 p refs
(S0205034)
(AD-A077323; NRL-8353) Avail: NTIS HC A03/MF A01 CSCL 07/4

Four catalysts (hopcalite, Whetlerite, a supported palladium, and a supported platinum) were tested for efficiency in promoting the oxidation of carbon monoxide (CO). At room temperature and 50% RH, hopcalite has no catalytic capability and platinum has practically none. At room temperature and 15% RH, hopcalite is superior to platinum in catalyzing the oxidation of CO. Hopcalite is more efficient than either of the other three catalysts in the 52 to 66 C (125 to 150 F) temperature range at both humidities. Platinum and palladium are superior to both hopcalite and Whetlerite at both humidities in the 113 to 135 C (235 to 275 F) temperature range. Higher humidity decreases the co-oxidizing capabilities of hopcalite and Whetlerite but does not do so for platinum and palladium. Whetlerite is in the lower-performing group of catalysts under all except one of the different conditions used in the tests. For the hopcalite, palladium, and platinum catalysts there is a temperature below 135 C (275 F) and above 68 C (155 F) at which CO can be oxidized efficiently. GRA

N80-18130# Massachusetts Univ., Amherst. Astronomy Research Facility.
INFRARED EMISSION SPECTROSCOPY OF LOW PRESSURE GASEOUS DISCHARGES, II Interim Report
Peter Hansen and Hajime Sakai Jul. 1979 49 p refs
(Contract F19628-76-C-0087; AF Proj. 2310)
(AD-A078796; UMASS-ARF-79-305; AFGL-TR-79-0150; SCIENTIFIC-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report summarizes a survey study aimed at improving our understanding of the physical processes which control the infrared radiation in the upper atmosphere. The experiment is conducted to generate various infrared bands of the atmospheric species in our large discharge chamber. Interpretations are given for the observed data by identifying the species involved and determining their parameters in terms of the atomic or molecular transitions. GRA

N80-18131# Indiana Univ., Bloomington. Dept. of Chemistry.
AN ACCURATE MODEL FOR SAMPLE DROPLET ACCELERATION IN ANALYTICAL FLAMES Interim Report
Richard E. Russo and Gary M. Hieftje Dec. 1979 21 p refs
Submitted for publication
(Contract N00014-76-C-0838; NR Proj. 051-622)
(AD-A078655; TR-24) Avail: NTIS HC A02/MF A01 CSCL 07/4

The experimentally observed velocity of an aerosol droplet in an air-acetylene flame is compared to the velocity calculated through a new mathematical model. The experimental droplet velocity is measured by means of stroboscopic photography of a stream of individual droplets sent into a flame at a known frequency and traveling very reproducible trajectories. Because the temporal spacing between these droplets is known, a measure of the instantaneous droplet location enables their velocity to be calculated. The droplet acceleration model was modified by incorporating into it a spatially changing flame rise velocity, which was assumed constant in earlier treatments. Excellent agreement has been found between calculated and measured droplet acceleration in the flame. GRA

N80-18132# Texas Univ. at Austin. Dept. of Chemistry.
AUGER SPECTRA OF AMMONIA ON ALUMINUM AND OXIDIZED ALUMINUM Progress Report, 1 Jan. - 31 Dec. 1979
Charles T. Campbell, J. W. Rogers, Jr., R. L. Hance, and J. M. White Nov. 1979 10 p refs Submitted for publication
(Contract N00014-75-C-0922; NR Proj. 056-578)
(AD-A078524; TR-10) Avail: NTIS HC A02/MF A01 CSCL 07/4

X-ray excited N(KVV) Auger spectra are reported for submonolayer amounts of ammonia adsorbed at 128K on clean and oxidized polycrystalline aluminum. The spectra were deconvoluted using an instrument function derived from the measured losses associated with the N(1s) photoionization region. The resulting spectra are compared with gas phase and condensed NH3 spectra. GRA

N80-18133# Vermont Univ., Burlington. Dept. of Chemistry.
SYNTHETIC APPROACHES TO MIXED-VALENCE CHEMISTRY
David B. Brown and James T. Wrobleski Nov. 1979 28 p refs
(Contract N00014-75-C-0756)
(AD-A078513; TR-18) Avail: NTIS HC A03/MF A01 CSCL 07/4

Several preparative routes to mixed-valence materials have been examined and the effect of the synthetic variables discussed. It has been shown that solubility is a dominant factor in the successful isolation of many such materials. Soluble metal cluster complexes are susceptible to sequential oxidation/reduction reactions which lead to mixed-valence clusters, and the importance and utility of electrochemical measurements in the preparation and understanding of these clusters is discussed. The preparation of mixed-valence polymers by solid-state reactions and by polymer growth techniques has been examined, and the types of behavior exhibited are shown to be explicable using arguments derived from the thermodynamics of solutions. GRA

N80-18134# SRI International Corp., Menlo Park, Calif.
CONTRIBUTION OF SURFACE CATALYSIS AND GAS PHASE REACTION TO CATALYTIC COMBUSTOR PERFORMANCE Final Report, 15 Aug. 1977 - 15 Aug. 1979
C. M. Ablow, S. Schechter, H. Wise, and B. J. Wood Oct. 1979 81 p refs
(Contract F49620-77-C-0123; AF Proj. 2308)
(AD-A078465; AFOSR-79-1146TR) Avail: NTIS HC A05/MF A01 CSCL 07/4

Engineering studies with catalytic combustors in the main burner and afterburner of aircraft propulsion systems have been concerned with the attainment of high combustion efficiency and flame stabilization of fuel-air mixtures outside the conventional flammability limits. The development of such devices that will perform at optimum efficiency over a broad range of operating conditions requires a detailed understanding of the flow of a reactive gas through ducts with catalytic walls, in which both hetorogeneous (wall) and homogeneous (gas) chemical reaction kinetics can occur. Of special interest to our study is the evaluation of the relative contributions of surface-catalyzed and gas-phase reactions to the total heat release rate in a catalytic combustor over a range of operating variables that include gas flow velocity, catalyst temperature, surface reactivity, and fuel-air ratio. Two catalytic combustor systems were employed. One involved stagnation point boundary layer flow with a catalytically active flat surface, the other duct flow in a multichannel catalytic monolith. The experimental studies were supplemented by theoretical calculations of heat release rates and temperature profiles based on models appropriate to the geometry and fluid dynamics of each catalytic combustion system. The result of our studies with dilute propane-air gas mixture and platinum coated surfaces have demonstrated that in both combustor configurations the gas phase combustion can be initiated by the wall-catalyzed reaction. GRA

N80-18135# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ON THE SYNTHESIS OF METASTABLE A-15 Nb3Si BY ION IMPLANTATION AND ON ITS SUPERCONDUCTING TRANSITION TEMPERATURE
M. T. Clapp (Mass. Univ., Amherst) and Robert M. Rose Nov. 1979 26 p refs
(Contract N00014-76-C-0297)
(AD-A077396; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The authors have found a new technique for the synthesis of metastable compounds of well defined composition; namely, ion implantation of a selected element into the desired crystal structure. Starting with a substrate material of A-15 Nb3Al0.9Si0.1, two basic approaches were tried towards the formation of A-15 Nb3Si by Si implantation: (1) direct replacement of the Al by Si, and (2) implantation into a surface layer depleted of Al. This later approach proved to be the most successful. It consisted of removing the Al by a diffusion anneal and replacing the Al deficiency by sequential Si implatation. Upon subsequent heat treatment, a surface layer of A-15 Nb3Al0.2Si0.8 was produced. Details of the experimental procedure and a discussion of the superconducting transition temperature measurements of the implanted surfaces are presented. GRA

N80-18136# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
THE PHYSICAL STRUCTURE OF TURBULENT FLAMES
N. A. Chigier and A. J. Yule Jan. 1979 11 p refs Presented at the Aerospace Sci. Meeting, New Orleans, 15-17 Jan. 1979
(Grant AF-AFOSR-3414-77; AF Proj. 2308)
(AD-A070008; AFOSR-79-0656TR; PAPER-79-0217) Avail: NTIS HC A02/MF A01 CSCL 21/2

This paper reports on measurements made in the mixing region of an axisymmetric turbulent propane/air jet issuing from a round nozzle into a low-velocity, low-turbulence intensity, unconfined co-flowing airstream. The exit velocity of the jet fluid and its turbulence intensity are sufficiently low to allow the formation of ring vortices within the mixing layer, bounded, on the inside, by the potential core of the jet and, on the outside, by the secondary airstream. High speed cine films show evidence of formation of vortices and flamelets at the interfaces. The changes in shape, movement and coalescence downstream of the nozzle are examined. Measurements of fluctuating velocity are made by a single particle-counting forwardscatter laser anemometer. Fluctuating temperature is measured with microthermocouples with 'in situ' measurement of time constant and direct compensation by digital signal recording and analysis. Variation in location and amplitude of peaks of velocity and temperature traces are directly associated with flame structures recorded by film. Signals from all probes are acquired and processed by PDP-8 and PDP-1103 Digital Equipment Corporation computers. GRA

N80-18137# State Univ. of New York at Buffalo. Dept. of Chemistry.
PREPARATION AND PROPERTIES OF ((TRIMETHYL SILYL)METHYL)-GALLIUM 3 COMPOUNDS
O. T. Beachley, Jr. and R. G. Simmons Nov. 1979 29 p refs Submitted for publication
(Contract N00014-78-C-0562)
(AD-A076123; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/2

A series of neutral organogallium(3) compounds which incorporate the (trimethyl silyl)methyl ligand, have been prepared and fully characterized by elemental analyses, NMR and infrared spectroscopy, molecular weight data, solubility properties and Lewis acid-base chemistry. The parent compound Ga(CH2SiMe3)3 prepared from GaC13 by a standard Grignard reaction in diethylether. The halogen derivatives were prepared from Ga(CH2SiMe3)3 by elimination reactions with HCl or HBr and exchange reactions with GaCl3 or GaBr3. GRA

N80-18138# Exxon Research and Engineering Co., Linden, N.J. Corporate Research Labs.

RADIATION AUGMENTED COMBUSTION Interim Report, 1 Jun. 1978 - 31 May 1979

Anthony E. Cerkanowicz Jul. 1979 33 p refs
(Contract F49620-77-C-0085; AF Proj. 2308)
(AD-A077563; EXXON/GRUS.2BFB-79; AFOSR-79-1096TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

Radiative initiation and enhancement of combustion in unsensitized fuel-air mixtures via the photodissociation of oxygen molecules and combustion intermediary species are being investigated. Pulsed VUV (vacuum ultraviolet) light sources and continuous UV (ultraviolet) light sources are being used for this purpose. Experimental efforts are directed at elucidation of light source conversion efficiency and spectral characteristics, and reactant mixture-photon interactions. A complementary effort involves the development of analytical capability required for modeling photochemical initiation and enhancement of combustion. GRA

N80-18139# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.

SPECTROELECTROCHEMICAL MONITORING OF ELECTRODE REACTIONS BY MULTIPLE SPECULAR REFLECTANCE SPECTROSCOPY Technical Report, 15 Jun. 1978 - 1 Jul. 1979

Charles E. Baumgartner, Gary T. Marks, David A. Aikens, and Herbert H. Richtol Oct. 1979 24 p refs Submitted for publication
(Contract N00014-78-C-0494)
(AD-A076951; TR-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

Multiple specular reflection is the basis of a new thin layer spectro-electrochemical cell which does not use optically transparent electrodes, the optical sensitivity of which exceeds that of cells using transparent electrodes by a factor of several hundred. As a result, the ability to detect short-lived intermediates and weakly absorbing species in spectroelectrochemical studies is much improved. Absorbance changes less than 5 x 10 to the minus 5 absorbance units per electrode reflection are readily observed. A cell 4cm long with a 120 micrometers spacing, operated to give approximately 330 reflections, was used to monitor optically the reduction of methylene blue and the reoxidation of the leuco form at concentrations as low as 5 x 10 to the minus 7M. For both reactions, the absorbance is linear with square root of t from 10 ms to ca 3 s, and the magnitude agrees well with values calculated from the geometry of the optical path. Among the advantages of the new technique are greatly increased optical sensitivity and the ability to use electrode materials which are not transparent. GRA

N80-18140# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.

IGNITION AND FLAME PROPAGATION IN SPRAYS Final Report, 1 Jun. 1976 - 30 Aug. 1979

William A. Sirignano and Suresh K. Aggarwal 1 Dec. 1979 47 p refs
(Grants DAAG29-76-G-0266; DAAG29-77-G-0145; DA Proj. 1L1-61102-BH-57)
(AD-A078889; MAE-1459; ARO-14052.2-E) Avail: NTIS HC A03/MF A01 CSCL 21/2

Flame initiation and propagation through an air-fuel vapor-fuel drop system is numerically modeled in a cylindrical one-dimensional combustor. Using an unsteady formulation and allowing unsteady mass, momentum and heat transfer between the two phases, results have been obtained to observe the effects of activation energy, preexponential factor, initial droplet size, initial temperature, stoichiometric ratio and diffusivity on the flame propagation. It is observed that the process is essentially unsteady. Also, unlike pre-mixed case, heterogeneous combustion gives rise to large variation in fuel-air ratio, which could produce a secondary diffusion flame in the wake of a propagating flame. GRA

N80-18141# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

ISOMERIZATION AND DECOMPOSITION OF 1.2 EPOXY PROPANE BY INTENSE CO2 LASER RADIATION [ISOMERISIERUNG UND ZERFALL VON 1.2-EPOXIPROPAN BEI BESTRAHLUNG MIT INTENSIVEN CO2 - LASERLICHT]

M. Knebe and H. G. Wagner Nov. 1978 23 p refs In GERMAN
(MPIS-18/1978; ISSN-0436-1199) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Goettingen, West Germany DM 6.30

The competing reactions of isomerization and photolysis of 1,2-epoxy propane under intense infrared radiation from a CO2 laser were studied quantitatively in order to clarify some mechanisms of hydrocarbon oxidation. The experimental work was done at different pressures using a CO2 laser pulse energy of 0.1 and 1.5 joules. Direct heating by infrared quanta absorption and energy transfer from SF6 molecules were used. Results are presented in charts showing the concentration of the different reaction products such as aldehyde, acetone, and vinylic ether as a function of 1,2-epoxy propane partial pressure, of the laser pulse intensity, and of the dilutant partial pressure. Author (ESA)

N80-18142# National Technical Information Service, Springfield, Va.

CARBON AND GRAPHITE. PART 3. GRAPHITE--PHYSICAL, MECHANICAL, AND STRUCTURAL STUDIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Oct. 1979

Mona F. Smith Dec. 1979 105 p Supersedes NTIS/PS-78/1052; NTIS/PS-77/0846; NTIS/PS-76/0687; NTIS/PS-75/615; NTIS/PS-75/181
(PB80-802390; NTIS/PS-78/1052; NTIS/PS-77/0846; NTIS/PS-76/0687; NTIS/PS-75/615; NTIS/PS-75/181) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

The physical, mechanical, and structural properties of graphite are examined. Graphite composites and fibers studies are excluded along with graphite chemistry. The use of graphite as a reactor material is reported. This updated bibliography contains 102 abstracts, 29 of which are new entries to the previous edition. GRA

N80-18143# National Technical Information Service, Springfield, Va.

CARBON AND GRAPHITE. PART 3. GRAPHITE--PHYSICAL, MECHANICAL, AND STRUCTURAL STUDIES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976

William E. Reed Dec. 1979 232 p
(PB80-802382) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

The physical, mechanical, and structural properties of graphite are discussed. Studies of graphite composites and fibers are excluded along with graphite chemistry. The majority of the studies deal with the use of graphite as a reactor material. This updated bibliography contain 226 abstracts, none of which are new entries to the previous edition. GRA

N80-18144# National Technical Information Service, Springfield, Va.

CARBON AND GRAPHITE. PART 2. CARBON AND GRAPHITE COMPOSITES - EXCLUDING CARBON FIBER COMPOSITES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979

William E. Reed Dec. 1979 262 p Supersedes NTIS/PS-78/1051; NTIS/PS-77/0845; NTIS/PS-76/0686; NTIS/PS-75/614; COM-74-11527
(PB80-802374; NTIS/PS-78/1051; NTIS/PS-77/0845; NTIS/PS-76/0686; NTIS/PS-75/614; COM-74-11527) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Carbon and graphite composites are studied. Topics include nonfiber carbon reinforcement, carbon or graphite matrix composites, applications, properties, fabrication, and structural analysis. The majority of research concerns aircraft components and ablative materials for rockets. This updated bibliography contains 262 abstracts, 48 of which are new entries to the previous edition. GRA

N80-18145# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 1: CARBON AND GRAPHITE FIBERS AND FIBER COMPOSITES, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Sep. 1977 - Oct. 1979
William E. Reed Dec. 1979 249 p Supersedes NTIS/PS-78/1050; NTIS/PS-77/0844; NTIS/PS-76/0685; NTIS/PS-75/613; COM-74-11527
(PB80-802366; NTIS/PS-78/1050; NTIS/PS-77/0844; NTIS/PS-76/0685; NTIS/PS-75/613; COM-74-11527) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Citations cover reinforcement of numerous polymers and metals by carbon and graphite fibers. Topics include processing, design, properties, stress analysis, and performance of the composite structures or parts. Composites from polyimide, epoxy, and aluminum matrices are among the types cited. Fabrication and testing of materials for rocket nozzles, reentry vehicles, aircraft components, automobiles, and ships are included. This updated bibliography contains 241 abstracts, 100 of which are new entries to the previous edition. GRA

N80-18146# National Technical Information Service, Springfield, Va.
CARBON AND GRAPHITE. PART 4. GRAPHITE--CHEMICAL PROPERTIES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Oct. 1979
Diane M. Cavagnaro Dec. 1979 249 p Supersedes NTIS/PS-78/1053; NTIS/PS-77/0847; NTIS/PS-76/0688; NTIS/PS-75/616
(PB80-802408; NTIS/PS-78/1053) Avail: NTIS HC $30.00/MF $30.00 CSCL 11D

Citations on the chemistry of graphite are presented. Topics include vaporization, thermodynamics, surface chemistry, intercalation compounds, chemisorption, and oxidation. This updated bibliography contains 228 abstracts, 32 of which are new entries to the previous edition. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-18147 Missouri Univ. - Columbia.
ENVIRONMENTAL EFFECTS ON THE MECHANISM OF FRETTING FATIGUE IN 7075-T6 ALUMINUM Ph.D. Thesis
Cheung Jarm Poon 1979 116 p
Avail: Univ. Microfilms Order No. 8002392

A cyclic type of loading with a sinusoidal waveform at a frequency of 10 Hz was applied to the specimen, which was under a normal contact pressure of 6000 psi with a fretting pad at the same time, until failure occurred. Statistical analysis of the data led to the conclusion, with at least 95 percent confidence, that the chemical corrosion process in fretting fatigue plays the dominant role in reducing fatigue life. Fractographic analysis on failed specimens indicates that different mechanisms of fretting fatigue resulted from different environments. In laboratory air environment, the generation of pits due to fretting is considered to be the cause of crack initiation which led to subsequent early failure of the specimen. In vacuum environment, the fretting damage was less severe, and crack initiation is considered to result from the action of tangential surface stress on welded metallic junctions between two contacting surfaces. Dissert. Abstr.

N80-18148 Missouri Univ. - Columbia.
CHARACTERIZATION OF METAL DAMAGE THROUGH INFRARED TECHNOLOGY Ph.D. Thesis
Sharon Lynn Langenbeck 1979 275 p
Avail: Univ. Microfilms Order No. 8002376

Five different materials, 410 Stainless Steel, Waspaloy (y.s. 120), 17-4 PH Stainless Steel, Ti-6A1-2Sn-4Zr-2Mo, and Waspaloy (y.s. 154), were used to characterize the thermal profile of a fatigue crack. Both the 410 Stainless Steel and Waspaloy (120) were tested under the new and used (wear) conditions. During stable crack growth the change in temperature at the crack tip was quite small and steadily increased as the stress intensity increased. The last few cycles before failure showed a sharp increase in the thermal gradient with no cooling below ambient at the crack tip. From the ambient temperature both an increase and a decrease in temperature was observed during stable crack growth. The cooling at maximum load is response from elastic loading while the heating is due to a plasticity effect. At lower stress levels the decrease in temperature correlated quite well with the theoretical data. However, as the stress increased the experimental data had a larger change in temperature than predicted. Dissert. Abstr.

N80-18149 Ohio State Univ., Columbus.
MECHANISMS OF RECOVERING LOW CYCLE FATIGUE DAMAGE IN INCOLOY 901 Ph.D. Thesis
Robert Edward Schafrik 1979 259 p
Avail: Univ. Microfilms Order No. 8001823

The effect of thermal treatment and hot isostatic pressing (HIP) on eliminating low cycle fatigue (LCF) damage was investigated during tests done in air at 500 F at a total strain range of 0.75%. The mechanisms of crack initiation and crack propagation in baseline specimens were determined and used as the basis of comparison for the rejuvenated specimens. A pre-rejuvenation damage level of 800 cycles (60% of crack initiation) was selected. Some specimens to be HIP processed were ceramic coated; the rest were left uncoated. Post-HIP testing revealed that LCF properties were adversely affected by surface microstructural damage caused by the HIP processing. Thermal rejuvenation, consisting of a standard solution treatment and double aging, was partially successful in recovering fatigue properties. Initiation life was extended by 400 cycles and cycles to failure was extended by 600 cycles. This behavior is explained in terms of microstructural damage. Dissert. Abstr.

N80-18150 Ohio State Univ., Columbus.
ELECTROCHEMICAL INVESTIGATION OF HOT CORROSION Ph.D. Thesis
George William Watt 1979 198 p
Avail: Univ. Microfilms Order No. 8001854

Four different electrodes were investigated in molten sodium sulfate: (1) a Pt foil immersed in the melt; (2) a silver wire in a mixture of 10 m/o Ag2SO4 in Na2SO4, enclosed in a mullite tube; (3) a Pt-wire immersed in Na2SO4 over which an equilibrated mixture of SO3/SO2/O2 is passed, the system enclosed in a mullite tube; and (4) a Pt-wire in oxygen inside a calcia-stabiized zirconia tube. These electrodes were then employed to study the corrosion of pure Ni, pure Cr, and the compound NiAl covered with thin molten sodium sulfate films and various gaseous atmospheres over the salt film. Open circuit potential measurements with Ag/Ag2SO4, SO2/O2 gas, and fully or partially stabilized ZrO2 reference electrodes were made. Galvanic current measurements with the corroding metal coupled to a Pt electrode as well as potentiostatic polarizations were also accomplished. The results are interpreted in terms of a scale fluxing model and a scale growth and dissolution model analogous to scale growth and evaporation in metal/gas reactions. Dissert. Abstr.

N80-18151 Illinois Univ. at Urbana-Champaign.
ANELASTIC STUDIES OF INTERSTITIALLY TRAPPED HYDROGEN IN NIOBIUM Ph.D. Thesis
Philip Emerson Zapp 1979 140 p
Avail: Univ. Microfilms Order No. 8004311

The local motion of hydrogen trapped by oxygen and nitrogen solutes was studied using anelastic relaxation methods. Internal friction peaks due to the reorientation of O-H pairs were measured in the < 100 >, < 110 > and < 111 > directions of niobium single crystals. Reorientation occurs by hydrogen jumping around the fixed O interstitial trap, the frequency of which was found to be higher in The < 111 > direction than in the < 110 > direction. The activation enthalpy of motion was 0.12 eV in The former direction and 0.18 eV in the latter. Two probable models for the O-H defect are (1) a single O-H pair with < 100 > monoclinic point symmetry, and (2) two types of pairs, one with < 100 > orthorhombic symmetry and the other with < 100 > monoclinic symmetry. The jump frequency of nitrogen-trapped hydrogen in the temperature range of about 40 to 80K was studied with strain relaxation and low frequency internal friction techniques. The jump frequency at a given temperature was found to be lower than that of oxygen-trapped hydrogen, and it is in good agreement with the Flynn-Stoneham theory of phonon-assisted quantum tunneling. Dissert. Abstr.

N80-18152 Illinois Univ. at Urbana-Champaign.
THE CHARACTERIZATION OF THE THERMODYNAMICS OF SPECIFIC AND NONSPECIFIC INTERACTIONS IN LIQUID METAL MIXTURES Ph.D. Thesis
Kenneth Richard Cox 1979 186 p
Avail: Univ. Microfilms Order No. 8004152

The application of three different solution models to liquid metal mixtures was investigated. A Dolezalek type chemical model was used to represent activity coefficient and phase equilibria behavior for liquid metal systems which are expected to form strong complexes. A general linear least squares technique for calculating chemical theory parameter values was proposed and a physical model which includes the electron contributions to the total energy was applied to liquid metal systems for which no strong complexes were expected to form. A combination chemical physical model was proposed to deal with specific interactions. The model uses a single physical parameter to represent each binary pair. One chemical parameter is used for each complex formed in the liquid metal. The model is applied to represent both activity coefficient and solid liquid phase boundary data. A comparison is made between predicted and experimental results. The experimental activities were obtained using a multiple Knudsen cell-mass spectrometer technique. The results were compared with the predictions of the single parameter physical model. Dissert. Abstr.

N80-18153# National Research Council of Canada, Ottawa (Ontario).
UTILIZATION OF SUPERPLASTICITY IN INDUSTRIAL METAL FORMING
G. H. Gesseinger 1980 15 p refs Transl. into ENGLISH from Radex-Rundsch. (Austria), v. 2, 1977 p 124-130
(NRC/CNR-TT-1946; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The advantages and limitations of superplastic sheet metal forming are discussed. The typical alloy groups such as nickel superalloys, carbon steels, and zinc alloys are described in relation to their sheet metal forming, isothermal solid blank forming, and the semifinished products. M.M.M.

N80-18154# Materials Research Labs., Melbourne (Australia).
FRACTURE TOUGHNESS OF FATIGUE-DAMAGED STEEL SPECIMENS
Graham Clark Jun. 1979 20 p refs
(MRL-R-749; AR-001-827) Avail: NTIS HC A02/MF A01

The fracture toughness of high quality gun steel is examined. Conditions under which the fatigue precracking levels specified for K sub Ic tests may produce unreasonably high values of K sub Ic leading to an increased possibility of in-service fracture of components designed using these values, are described. M.G.

N80-18155*# United Technologies Research Center, East Hartford, Conn.
STUDY OF THE EFFECTS OF GASEOUS ENVIRONMENTS ON THE HOT CORROSION OF SUPERALLOY MATERIALS Final Report
John G. Smeggil and N. S. Bornstein 5 Feb. 1980 93 p
(Contract NAS3-21376)
(NASA-CR-159747; R79-914387-4) Avail: NTIS HC A05/MF A01 CSCL 11F

The effect of the gaseous corrodent NaCl on the high temperature oxidation and sodium sulfate induced hot corrosion behavior of alumina formers, chromia formers, and the superalloy B-1900 was examined. Isothermal experiments were conducted at 900 C and 1050 C in air in the presence and absence of NaCl vapors. Microstructural changes in oxide morphology and increased rates of oxidation were observed when NaCl(g) was present. It is hypothesized that the accelerated rates of oxidation are the result of removal of aluminum from the scale substrate interface and the weakening of the scale substrate bonds. The aluminum removed was redeposited on the surfaces in the form of alumina whiskers. For the superalloy B-1900, alumina whiskers are also formed, and the alloy oxidizes at catastrophic rates. In the case of Ni-25Cr alloy, NaCl vapors interact with the scale depleting it of chromium. R.C.T.

N80-18156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF A SOLAR SELECTIVE COATING SYSTEM USING BLACK COBALT OXIDE FOR HIGH TEMPERATURE SOLAR COLLECTORS
G. McDonald 1980 16 p refs Proposed for presentation at Intern. Conf. on Metal Coatings, San Diego, Calif., 21-25 Apr. 1980; Sponsored by Am. Vacuum Soc.
(NASA-TM-81385; E-293) Avail: NTIS HC A02/MF A01 CSCL 10A

Black cobalt oxide coatings (high solar absorptance layer) were deposited on thin layers of silver or gold (low emittance layer) which had been previously deposited on oxidized (diffusion barrier layer) stainless steel substrates. The reflectance properties of these coatings were measured at various thicknesses of cobalt for integrated values of the solar and infrared spectrum. The values of absorptance and emittance were calculated from the measured reflectance values, before and after exposure in air at 650 C for approximately 1000 hours. Absorptance and emittance were interdependent functions of the weight of cobalt oxide. Also, these cobalt oxide/noble metal/oxide diffusion barrier coatings have absorptances greater than 0.90 and emittances of approximately 0.20 even after about 1000 hours at 650 C. Author

N80-18157*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF IMPURITIES IN COAL-DERIVED LIQUIDS ON ACCELERATED HOT CORROSION OF SUPERALLOYS Final Report
Daniel L. Deadmore and Carl E. Lowell Mar. 1980 30 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-81384; DOE/NASA/2593-79/13; E-292) Avail: NTIS HC A03/MF A01 CSCL 11F

A Mach 0.3 burner rig was used to determine the effects of potential coal derived liquid fuel impurity combustion of products on hot corrosion in IN-100, IN-792, IN-738, U-700, Mar M-509, and 304 stainless steel. The impurities, added as aqueous solutions to the combustor, were salts of sodium, potassium, vanadium, molybdenum, tungsten, phosphorus, and lead. Extent of attack was determined by metal consumption and compared to the effects of sodium alone. Vanadium, molybdenum, tungsten, phosphorous, and lead in combination with sodium all resulted in increased attack as compared with sodium alone at some temperatures, apparently due in large part to the extension of the formation of liquid deposits. Varying the sodium-potassium ratio had little effect for ratios less than 1:3 for which reduced, but measurable, attack was observed. K.L.

N80-18158# Rock Island Arsenal, Ill. Engineering Directorate.
AN EVALUATION OF PROCESSES FOR THE BLACKENING OF PRECIPITATION-HARDENED STAINLESS STEELS
J. T. Menke Jun. 1979 32 p
(AD-A075134; SARRI-EN-TR-79-01) Avail: NTIS HC A03/MF A01 CSCL 11/6

Precipitation-hardened stainless steels (corrosion-resistant materials with excellent mechanical properties) require dark, nonreflective finishes to be useful for most military applications. Work involving such finishes was conducted to determine which of the various blackening processes could be used for these materials without decreasing their inherent corrosion resistance. Corrosion tests were conducted on coated and uncoated 17-4, 17-7, 14-8Mo, and AM350 alloys in the annealed and precipitation-hardened condition. The blackening processes evaluated included black chromium plating, zinc phosphating, molten sodium dichromate, and alkaline-oxidizing treatments. Activated and passivated specimens were used as controls in the corrosion tests. Potentiostatic, potentiodynamic, and 5% salt spray (astm-b117) tests were used to evaluate the various specimens. Salt-spray tests showed that maximum corrosion protection was provided by black chromium and zinc phosphate coatings. All corrosion tests showed that black coatings produced by the alkaline-oxidizing process provided varying degrees of corrosion resistance, dependent upon the alloy or thermal treatment used, and that coatings produced by the molten sodium dichromate treatment provided poor corrosion protection. Black coatings on the 14-8Mo and AM350 alloys exhibited the best corrosion resistance. GRA

N80-18159# Naval Research Lab., Washington, D. C.
FATIGUE CRACK GROWTH OF A508 STEEL IN HIGH-TEMPERATURE, PRESSURIZED REACTOR-GRADE WATER
W. H. Cullen, Jr., V. Provenzano, K. J. Torronen, H. E. Watson, and F. J. Loss 28 Sep. 1979 58 p refs
(AD-A075506; NRL-MR-4063; NRL/NUREG-CR-0969) Avail: NTIS HC A04/MF A01 CSCL 11/6

Fatigue crack growth tests of A508-2 pressure vessel steel have been conducted at two test temperatures (93 C and 288 C) using a variety of constant amplitude waveforms. The load ratios were either 0.1 or 0.125, and the water chemistry was carefully monitored and controlled so as to simulate the nominal pressurized water reactor chemistry. The test procedures are described, and an examination of all the data indicates that the results fall into one of two rather clearly defined categories. One band of data, termed 'low', lies close to or essentially on, the ASME Section XI Code air environment default line. The other band of data, termed 'high', resides approximately midway between the ASME Sec. XI air and water environment default lines. The two bands of data are the result of certain combinations of the waveform and temperature variables listed above, and are determined by the following rules: (1) a ramp time in excess of one second is needed to obtain the high crack growth rate; and (2) the application of a hold time, together with a high temperature, serves to depress a normally high crack growth rate test (i.e., one with a long ramp time) and force it into the low category. A hydrogen embrittlement model is used as a basis for the explanation of this behavior. During the longer ramp times (approximately one second) hydrogen formed by aqueous hydrolysis diffuses into the plastic zone resulting in local embrittlement. GRA

N80-18160# Illinois Univ. at Urbana-Champaign. Dept. of Metallurgy and Mining Engineering.
HYDROGEN-EMBRITTLEMENT-HYDRIDE FRACTURE
S. Gahr, B. J. Makenas, and H. K. Birbaum Sep. 1979 20 p refs
(Contract N00014-75-C-1012)
(AD-A076912) Avail: NTIS HC A02/MF A01 CSCL 20/11

Consideration is given to causes for the extreme brittleness observed for most hydrides. Surface energies for cleavage of the beta NbH0.82 f.c. orthorhombic hydride along the (100) and (110) are obtained using fracture mechanics methods. The values are shown to be about equal to those of b.c.c. niobium. The relative surface energies of niobium and NbH are consistent with measurements of phonon frequencies and elastic constants. None of the data indicates any decrease of atomic bonding due to the incorporation of hydrogen in the metal lattice. Dislocation mobility is considered on the basis of T.E.M observations and the crystal structure. It is shown that half of the /110/ <111> slip systems cause hydrogen disordering and therefore experience a high lattice frictional stress. Domain boundaries also are shown to be dislocation barriers. Hydride brittleness is considered to result from the decrease in dislocation mobility and in the slip systems available to cause plastic blunting at elastic discontinuities. GRA

N80-18161# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWERS Research and Development Status Report, 5 Mar. - 4 Jun. 1979
R. E. Lewis Jun. 1979 23 p refs
(Contract F33615-78-C-5203; DARPA Order 3575)
(AD-A077197; LMSC-D677934) Avail: NTIS HC A02/MF A01 CSCL 11/6

Advanced aluminum alloys are to be developed that will provide major payoffs for important new aircraft, spacecraft, and missile systems in the next decade. Payoffs will result from weight savings of structural components which, in turn, lead to increased range, payload, service life, and decreased life-cycle cost. Recently conducted feasibility and design tradeoff studies provide a basis for selecting certain property goals for improved aluminum alloys that will result in significant weight savings. GRA

N80-18162# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
DEVELOPMENT OF ADVANCED ALUMINUM ALLOYS FROM RAPIDLY SOLIDIFIED POWDERS FOR AEROSPACE STRUCTURAL APPLICATIONS Interim Technical Report, 5 Mar. - 4 Sep. 1979
R. E. Lewis Sep. 1979 137 p refs
(Contract F33615-78-C-5203; ARPA Order 3575)
(AD-A077800; LMSC-D678772) Avail: NTIS HC A07/MF A01 CSCL 11/6

Advanced aluminum alloys are being developed that will provide major payoffs in terms of weight savings for new aerospace structures. The two property goals are: (1) a 30-percent increase in modulus of elasticity-to-density ratio, and (2) a 20-percent increase in modulus of elasticity-to-density ratio plus a 20-percent increase in strength-to-density ratio, when compared to Al 7075-T76 and without a significant loss in other properties important for structural applications. The program is organized into three phases: (1) a fundamental alloy and process development study; (2) scale-up of two best alloys and evaluation of mill product forms; (3) design evaluation involving selected redesign of aerospace components, analysis of payoffs, and recommendations for manufacturing technology development. Phase 1 activity, to be completed in the first two years, is organized into four Tasks: (1) development of advanced aluminum alloys containing lithium; (2) development of advanced aluminum alloys that do not contain lithium; (3) quantitative microstructural analyses and mechanical property correlations; (4) study of aerospace structural applications for advanced aluminum alloys including development and application of a method for predicting weight savings. Phase 1 activity is described below; Phases 2 and 3 have not been initiated. GRA

N80-18163# Warwick Univ. Coventry (England). Dept. of Physics.
COMPTON SCATTERING STUDIES OF METALS AND HYDRIDES WITH 412 KeV GAMMA RADIATION Final Report, Oct. 1977 - Sep. 1979
Malcolm J. Cooper Sep. 1979 35 p refs
(Grant DA-ERO-77-G-099; DA Proj. 1T1-61102-BH-57)
(AD-A078801) Avail: NTIS HC A03/MF A01 CSCL 20/6

A 412 KeV Compton spectrometer has been designed at Warwick, and commissioned at the SRC Rutherford Laboratory. The performance of the system was highly satisfactory, but routine operation of the equipment has been hampered by deterioration in the resolution of the detector, and delays have occurred as a result of faults in the computerised data acquisition system. The Compton profile of vanadium has been measured, and is found to be in disagreement with theory, the anisotropies being smaller than predicted. In related investigations evidence for the failure of the impulse approximation has been found, and the viability of obtaining cohesive energies from Compton profiles has been assessed. GRA

N80-18164# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
SOME ASPECTS OF FATIGUE CRACK CLOSURE IN TITANIUM ALLOYS Final Scientific Report, 1 Jan. - 30 Jun. 1979
C. J. Beevers 31 Aug. 1979 42 p refs Prepared for AF Office of Sci. Res., Washington, D.C. and European Office of Aerospace Res. and Develop., London
(Grant AF-AFOSR-0045-79; AF Proj. 2301)
(AD-A076948; EOARD-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 11/6

Fatigue crack growth at intermediate rates and R 0.1 has been measured in compact tension specimens of the alloys Ti-6Al-4V and Ti-6Al-5Zr-0.5Mo-0.25Si. Crack length was determined from the output of a crack mouth displacement gauge and by using a d.c. potential drop technique. The incidence of crack closure was examined during fatigue by using both of the above methods; COD was found to be more reliable for closure measurement than potential drop. In contrast to the fine microstructured Ti-6Al-4V, the coarse Ti-6Al-5Zr-0.5Mo-0.25Si showed substantial load transfer across the crack faces during fatigue and this was attributed to a 'non-closure' mechanism. Low crack growth rates in the latter alloy were rationalized in terms of an effective delta K. Marked reductions in growth rate produced by variable amplitude loading at Ti-6Al-4V could not be explained by crack closure. GRA

N80-18165# National Bureau of Standards, Washington, D.C. Metal Science and Standards Div.
APPLICATION OF SOLIDIFICATION THEORY TO RAPID SOLIDIFICATION PROCESSING Semiannual Report, 1 Apr. - 30 Sep. 1979
W. J. Boettinger, J. W. Cahn, S. R. Coriell, and J. R. Manning Oct. 1979 19 p refs
(ARPA Order 3751)
(AD-A078947) Avail: NTIS HC A02/MF A01 CSCL 13/8

Work is reported on the following areas of rapid solidification processing: (1) Microsegregation and Stability at the Solidification Interface, (2) Glass Formation by Rapid Cooling of Eutectic Systems, (3) Compositional Limits Imposed by Thermodynamics during Rapid Solidification and Relative Stability of Heterogeneous Microstructures. The theory of rapid solidification was investigated to determine whether major aspects of rapid solidification processes can be explained by conventional solidification theory and to examine non-equilibrium effects which can arise. In particular, segregation effects, glass-forming tendencies, and rules governing the formation of equilibrium and non-equilibrium phases, including alloy composition limits, reaction sequences and metastable phase formation, will be investigated. GRA

N80-18166# Technion - Israel Inst. of Tech., Haifa. Solid State Inst.
TRANSPORT AND RECOMBINATION PROPERTIES OF LEAD TIN TELLURIDE ALLOYS Final Report, 1 Jan. 1978 - 30 Sep. 1979
Kurt Weiser 1979 13 p
(Grant AF-AFOSR-3509-78; AF Proj. 2306)
(AD-A078687; AFOSR-79-1260TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Doping effects and photoconductivity were studied for single crystal films of lead tin telluride (Pb(0.8)Sn(0.2)Te) grown by vapor phase epitaxy. Growth of films was carried out by an evaporation condensation process in which the alloy was evaporated from a polycrystalline source and the vapor was condensed on a barium fluoride substrate. Interesting doping effects were obtained with indium which produces a deep level in the gap with unusual properties. Extensive galvanomagnetic measurements suggest that indium enters as a self-compensating impurity and pins the Fermi level near midgap, in contrast to other Group III elements such as gallium and thallium which dope the material n-type and p-type, respectively. An investigation of the kinetics of photoconductivity revealed that around the 'device temperature' of 77 K, the recombination of excess carriers is thermally activated, but becomes approximately temperature independent below 50 K. These results and the magnitude of the photoconductive life-time lead to the surprising conclusion that contrary to prevailing opinion, Auger recombination is not the dominant recombination mechanism for samples with carrier concentration in the 1-10/10 to the 16th power cc range. GRA

N80-18167# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Paris (France). Lab. de la Direction Technique.
STUDY OF THE RELATIONSHIP OF MICROPOROSITY IN NICKEL-BASED ALLOYS TO STRUCTURAL HARDENING WITH TITANIUM AND ALUMINUM DURING PRECISION CASTING European Concerted Action - COST 50. Materials for Gas Turbines, Project F5/1 Final Report [ETUDE DE LA SENSIBILITE A LA MICROPOROSITE D'ALLIAGES BASE NICKEL A DURISSEMENT STRUCTURAL PAR LE TITANE ET L'ALUMINIUM POUR FONDERIE DE PRECISION]
Philippe Julien, Jean-Claude Lecomte, Francoise Lavaud, Gerard Lesoult, Francine Wets, and Eric Bachelet 16 Nov. 1978 59 p refs In FRENCH Prepared in cooperation with Ecole des Mines de Paris
(Contracts DGRST-74-7-0152; DGRST-74-7-0153; DGRST-74-7-0154; DGRST-76-7-0608; DGRST-76-7-0609)
Avail: NTIS HC A04/MF A01

The correlations between chemical composition, the solidification process, and the tendency towards microporosity were studied in controlled casting and cooling conditions, using eight types of INCONCEL 738 alloy and eight types of C263 alloy. A negative correlation was found between the microporosity index of the C263 alloy and the fraction of eutectic gamma-carbide. The microporosity generation mechanisms are discussed pointing out that the alloys rich in carbon and carbide forming elements, such as Ti, Zr, Hf, show higher porosity independent of the eutectic quantity formed at the end of the solidification period, suggesting an alternative type of porosity forming mechanism. Author (ESA)

N80-18168# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
VARIATION IN THE MECHANICAL PROPERTIES AND IN THE FRACTURE STRENGTH OF AN ALUMINUM 7075 T651 PLATE, MEASURED IN THE DIRECTION OF THICKNESS
H. F. deJong Jul. 1978 43 p refs In DUTCH; ENGLISH summary
(VTH-LR-271) Avail: NTIS HC A03/MF A01

The variation in mechanical properties and fracture toughness in the direction of thickness of an aluminum plate (7075 T651 alloy) with a thickness of 25.4 mm was investigated using a constant strain test technique. The results show there is a distinct inhomogeneity in this direction for both the mechanical properties and fracture toughness as well as for hardness. Possible explanations for this behavior related to the microstructure are discussed. Author (ESA)

N80-18169# New Mexico Univ., Albuquerque. Technology Application Center.
CORROSION CHARACTERISTICS OF ALUMINUM ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Nov. 1979 41 p Sponsored in part by NTIS
(PB80-801137) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

This bibliography contains 162 citations concerning the corrosion characteristics of aluminum alloys. Included are articles dealing with corrosion resistance, stress corrosion cracking, intergranular corrosion, electrochemical corrosion, corrosion prevention, and corrosion, and fatigue tests of aluminum alloys. GRA

N80-18170# New Mexico Univ., Albuquerque. Technology Application Center.
CORROSION CHARACTERISTICS OF TITANIUM ALLOYS. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1973 - Nov. 1979
Gerald F. Zollars Dec. 1979 33 p Sponsored by NTIS
(PB80-801467) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations from international literature concerning the corrosion characteristics of titanium alloys are presented. Included are articles dealing with corrosion resistance, electrochemical corrosion, stress corrosion cracking, and corrosion tests of titanium alloys. This bibliography contains 126 citations. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-18171 Case Western Reserve Univ., Cleveland, Ohio.
CRYSTALLINITY, MORPHOLOGY, AND RHEOLOGY OF PVC-PLASTICIZER SYSTEMS Ph.D. Thesis
Pravin Laxminarayan Soni 1979 156 p
Avail: Univ. Microfilms Order No. 8002052

Gels of atactic PVC in certain solvents were found to yield higher than normal levels of crystallinity. The crystallites were found to have a broad range of melting points indicating the presence of a range of size and/or perfection. Upon orientation, gels from dimethyl phthalate were found to exhibit an anomalous meridional reflection in the wide angle X-ray diffraction fiber pattern. Plasticized PVC was found to consist of a heterogeneous distribution of plasticizer. The 100-200 A microdomains, which are essentially unplasticized, do not fuse at temperatures up to 165 C. However, at 180 C they begin to fuse, resulting in a more homogeneous distribution of the plasticizer. Increasing the size distribution of particles in PVC plastisols was found to decrease the shear thickening effect at the high shear rates. Addition of coarse particles was found to result in a reduction in the low shear viscosity. Dissert. Abstr.

N80-18172 Massachusetts Univ., Amherst.
CALORIMETRIC STUDIES OF POLYMER BLEND SYSTEMS Ph.D. Thesis
Charles Luce Ryan, Jr. 1979 222 p
Avail: Univ. Microfilms Order No. 8004983

Several polymer blend systems were studied utilizing Tian-Calvet microcalorimetry and differential scanning calorimetry. The model system was polystyrene/poly(2,6-dimethyl-1,4-phenylene oxide). Different substituents were added to the polystyrene chain and noted for the effect on the compatibility with PPO. Substituents included fluorine, chlorine, bromine and methyl in both the 2 and 4 position on the polystyrene phenyl group. The thermodynamics of mixing was observed utilizing Hess's law to measure the polymer-polymer heat of mixing. Equilibrium states below T sub g were explored using Tian-Calvet microcalorimetry coupled with Hess's law. This method allows the location of both the binodal and spinodal phase boundaries in the glassy state and the establishment of an UCST. The contours of the free energy-composition diagram are discussed. Dissert. Abstr.

N80-18173 Akron Univ., Ohio.
THE EFFECT OF PARTICLE SHAPE OF MODEL FILLER ON THE REINFORCEMENT OF ELASTOMERIC VULCANIZATES Ph.D. Thesis
Chuk Ling Leung 1980 139 p
Avail: Univ. Microfilms Order No. 8003394

The interaction between SBR vulcanizates and a model polymeric filler, polystyrene, was studied together with the effect of particle shape on the properties of such filled vulcanizates. It was found that for peroxide cured vulcanizates with polymeric filler, the degree of filler-polymer interaction decreased as the cure time was decreased from the optimum. Electron micrographs showed that after hot milling, the spherical polystyrene particles were distorted to ellipsoidal particles and aligned in the direction of milling. Physical properties of these vulcanizates, except the Young's modulus, were found to be anisotropic. Physical properties measured in the direction of filler alignment were found to be better than those measured transverse to filler alignment. The degree of anisotropy was also found to increase as the length of the ellipsoidal particles increased. Young's modulus was found to be independent of filler size, shape or orientation. Dissert. Abstr.

N80-18174 Akron Univ., Ohio.
STYRENE-BUTADIENE COPOLYMERIZATION IN ORGANOLITHIUM SYSTEMS Ph.D. Thesis
Ling-Kun Huang 1979 179 p
Avail: Univ. Microfilms Order No. 8003393

The organolithium-initiated copolymerization of styrene and butadiene was studied in detail using sec-butyl lithium as polymerization initiator in various solvents and solvent-mixtures. The composition of the copolymers and the chain microstructure were determined by NMR analysis. In bulk or in hydrocarbon solvents, the reactivity ratio of butadiene was much higher than that of styrene, in spite of the much higher reactivity of styrene in homopolymerization. Small additions of polar solvent had a significant effect on the reactivity ratios of styrene and butadiene, and also on the microstructure of polybutadiene. Arrhenius functions were plotted for the relationship between temperature and reactivity ratios. Within experimental error, the reactivity ratios of the styrene-butadiene pair were unaffected by changes in initiator concentration in the range from .001 to .01M. Dissert. Abstr.

N80-18175 Massachusetts Univ., Amherst.
THE PHYSICS OF POLY(ETHYLENE OXIDE)/POLY (METHYL METHACRYLATE) BLENDS Ph.D. Thesis
Dennis Mark Hoffman 1979 215 p
Avail: Univ. Microfilms Order No. 8004938

The PEO/PMMA blend is shown to be compatible at all compositions above the melting point of the PEO based on the behavior of the glass transition, the spherulite growth rate, and morphological evidence. The temperature dependence of spherulite growth follows the Fischer-Turnbull expression if a WLF modification of the diffusion term is used. If the glass transition temperature varies according to a Fox type equation, the depression of the spherulite growth rate follows from the hypothesis of compatibility in the melt. Further evidence supporting the contention of melt compatibility is found from the shift in the dynamic mechanical tan delta maxima and DSC transition phenomena. At intermediate compositions, these types of measurements are difficult to interpret because recrystallization and melting phemonena occur near T sub g. Morphological and crystallization behaviors are used to show that these compositions are also compatible. Dissert. Abstr.

N80-18176 Syracuse Univ., N. Y.
SPECIFIC SOLVENT INTERACTIONS AND STRESS INDUCED CRYSTALLINITY IN POLYMERS Ph.D. Thesis
Edward Balizer 1979 253 p
Avail: Univ. Microfilms Order No. 8004486

Stress induced crystallization was investigated in networks of trans polychloroprene and cis polyisoprene crosslinked by dicumyl peroxide. Theories of stress induced crystallization were used to analyze the experimental results. In addition, the equilibrium of intra- and intermolecular hydrogen bonds was investigated for syndiotactic and isotactic polyvinyl alcohol in aqueous solution. The partition function was calculated along with the chain second moment and its temperature coefficient. It was found that both tacticities, isotactic and syndiotactic, have negative temperature coefficients. The isotactic chain populates the transconformer with increasing intramolecular bond strength. However, the syndiotactic chain shifts from the trans to the lefthanded helical conformation with increasing bond strength. These results are in accord with negative temperature coefficients and the majority of experimental results. Author

N80-18177# Osaka City Univ. (Japan). Dept. of Mechanical Engineering.
ACOUSTIC FATIGUE STRENGTH OF FRP PANELS
T. Fujii, T. Fukuda, S. Iida, and M. Sano 1979 5 p refs
Repr. from Organic Coatings and Plastic Chem., vol. 40, 1979 p 682-687 Presented at the Am. Chem. Soc./Chem. Soc. of Japan Chem. Congr., Honolulu, 1-6 Apr. 1979 Sponsored by Am. Chem. Soc. Prepared in cooperation with Natl. Aerospace Lab., Tokyo
Copyright. Avail: NTIS HC A02/MF A01

Acoustic fatigue in four kinds of fiber reinforced panels (FRP) with three layers consisting of roving glass cloth and/or glass-fiber mat reinforced unsaturated polyester resin is examined. It is observed that the glass-fiber mat reinforced test panel may be more isotropic in the failure pattern than the roving glass cloth reinforced test panels. The experimental results indicate that the acoustic fatigue strength of FRP test panels is considerably lower than the fatigue strength of FRP materials tested under constant stress. Under several assumptions, the acoustic fatigue life of test panels is predicted by the experimental data of fatigue strength of FRP obtained from the constant stress testing. Good agreement with the experimental data is shown. Furthermore, the increase of acoustic fatigue strength of such test panels is experimentally investigated by bonding carbon FRP on the middle part of a panel or laminating carbon fiber woven tapes simultaneously in the molding process of panels. As a result, it is found that the latter stiffening method is more effective. M.G.

N80-18178*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WEAR PARTICLES OF SINGLE-CRYSTAL SILICON CARBIDE IN VACUUM
Kazuhisa Miyoshi and Donald H. Buckley Feb. 1980 24 p refs Submitted for publication
(NASA-TP-1624; E-077) Avail: NTIS HC A02/MF A01 CSCL 20B

Sliding friction experiments, conducted in vacuum with silicon carbide /000/ surface in contact with iron based binary alloys are described. Multiangular and spherical wear particles of silicon carbide are observed as a result of multipass sliding. The multiangular particles are produced by primary and secondary cracking of cleavage planes /000/, /10(-1)0/, and /11(-2)0/ under the Hertzian stress field or local inelastic deformation zone. The spherical particles may be produced by two mechanisms: (1) a penny shaped fracture along the circular stress trajectories under the local inelastic deformation zone, and (2) attrition of wear particles. M.G.

N80-18179*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TACKIFIER FOR ADDITION POLYIMIDES Patent Application
Terry L. StClair and John M. Butler, inventors (to NASA) (Virginia Polytechnic Inst. and State Univ., Blacksburg) Filed 7 Nov. 1979 18 p
(NASA-Case-LAR-12642-1; US-Patent-Appl-SN-092141) Avail: NTIS HC A02/MF A01 CSCL 11G

An improvement of addition polyimides wherein an essentially solventless, high viscosity laminating resin is synthesized from low-cost liquid monomers is presented. The improved process takes advantage of a reactive, liquid plasticizer such as monoethylphthalate which is used in lieu of an alcohol solvent, and helps solve a major problem of maintaining good prepreg tack and drape, or the ability of the prepreg to adhere to adjacent plies and conform to a desired shape during the layup process. This improvement results in both longer life of the polymer prepreg and the processing of low-void laminates and appears to be applicable to all addition polyimide systems. NASA

N80-18180*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF NEW ELASTOMERIC POLYTRIAZINES Patent Application
Robert W. Rosser and Roger A. Korus, inventors (to NASA) (San Jose State Univ., Calif.) Filed 25 Jul. 1980 15 p
(NASA-Case-ARC-11248-2; US-Patent-Appl-SN-060434) Avail: NTIS HC A02/MF A01 CSCL 11G

New crosslinked elastomeric polytriazines were prepared by a four step procedure which consists of: (1) forming a poly (imidoylamidine) by the reaction under reflux conditions of anhydrous ammonia with certain perfluorinated alkyl or alkyl-ether dinitriles; (2) forming a linear polytriazine by cyclizing the imidoylamidine linkages by reaction with certain perfluorinated alkyl or alkylether acid anhydrides or halides; (3) extending the linear polytriazine chain by further refluxing in anhydrous ammonia; and (4) heating to cyclize the new imidoylamidine linkages and thereby crosslink the polymer. NASA

N80-18181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REACTION BONDED SILICON NITRIDE PREPARED FROM WET ATTRITION-MILLED SILICON
Thomas P. Herbell, Thomas K. Glasgow, and Nancy J. Shaw 1980 20 p refs Presented at the 4th Ann. Conf. on Composites and Advan. Mater., Cocoa Beach, Fla., 20-24 Jan. 1980; sponsored by the Am. Ceram. Soc.
(NASA-TM-81428; E-329) Avail: NTIS HC A02/MF A01 CSCL 11G

Silicon powder wet milled in heptane was dried, compacted into test bar shape, helium-sintered, and then reaction bonded in nitrogen-4 volume percent hydrogen. As-nitrided bend strengths averaged approximately 290 MPa at both room temperature and 1400 C. Fracture initiation appeared to be associated with subsurface flaws in high strength specimens and both subsurface and surface flaws in low strength specimens. Author

N80-18182*# University of Southern Colorado, Pueblo.
ENVIRONMENTAL STRESS CRACKING OF POLYMERS Final Report
Kent I. Mahan 1980 99 p refs
(Grant NsG-806)
(NASA-CR-162825) Avail: NTIS HC A05/MF A01 CSCL 07/4

A two point bending method for use in studying the environmental stress cracking and crazing phenomena is described and demonstrated for a variety of polymer/solvent systems. Critical strain values obtained from these curves are reported for various polymer/solvent systems including a considerable number of systems for which critical strain values have not been previously reported. Polymers studied using this technique include polycarbonate (PC), ABS, high impact styrene (HIS), polyphenylene oxide (PPO), and polymethyl methacrylate (PMMA). Critical strain values obtained using this method compared favorably with available existing data. The major advantage of the technique is the ability to obtain time vs. strain curves over a short period of time. The data obtained suggests that over a short period of time the transition in most of the polymer solvent systems is more gradual than previously believed. Author

N80-18183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF THE WEIGHT LOSS AND ADHERENCE OF NINE DIFFERENT POLYIMIDE FILMS THERMALLY AGED AT 315 C AND 350 C IN AIR
Robert L. Fusaro Mar. 1980 34 p refs
(NASA-TM-81381; E-286) Avail: NTIS HC A03/MF A01 CSCL 07D

Thermal exposure experiments at 315 and 350 C were performed in air on nine different types of polyimides applied to thin 304 stainless steel foils. The tests were conducted to determine which polyimide was the most thermally stable and adherent when subjected to long exposure times at elevated temperatures. One polyimide designated PIC-7 was found to be more thermally stable than the others; however, it did not possess the adherent properties of PIC-2 and PIC-5. It was concluded that as far as thermal stability and adherence are concerned, five of the polyimides are more suitable for high temperature applications than the other four. K.L.

N80-18184# Defence Research Establishment, Ottawa. (Ontario). Environment Protection Section.
FLUOROALKYL SILOXANES AS LIQUID-REPELLENT FABRIC FINISHES. PART 1: A STATE-OF-THE-ART REVIEW AND SYNTHESIS OF THE MONOMERS
John W. Bovenkamp Jun. 1979 36 p refs
(AD-A073149; DREO-R-803-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/3

This project concerns the evaluation of fluoroalkyl-substituted siloxane polymers as liquid-repellent finishes. First, a brief literature review is given on the current state-of-the-art of these finishes. Second, syntheses and properties for a family of ten fluoroalkyl silanes are reported. These monomers include the best of those utilized in the literature as well as several new ones chosen to elucidate the effect of structure on liquid repellent properties. A second report will describe the method of polymerization, the liquid repellency values obtained with the homopolymers, and the results of copolymerizations with the much cheaper non-fluorinated silanes. GRA

N80-18185# Defence Research Establishment, Ottawa. (Ontario). Environment Protection Section.
FLUOROALKYL SILOXANES AS LIQUID-REPELLENT FABRIC FINISHES. PART 2: THE HOMOPOLYMERS AND THEIR COPOLYMERS WITH ALKYL SILANES
J. W. Bovenkamp Jun. 1979 37 p refs
(AD-A073150; DREO-R-804-Pt-2) Avail: NTIS HC A03/MF A01 CSCL 11/3

In this report the liquid-repellant properties of the homopolymers and selected copolymers of ten fluoroalkyl substituted silane monomers of varying structures are evaluated. The homopolymers of the silanes are synthesized, applied to nylon/cotton (50:50 weight percent) and cotton as finishes, and the oil and water repellency imparted to these fabrics ascertained by standard tests. In this manner it is possible to compare the effects of (1) length and degree of branching of the fluorinated alkyl chains, (2) the use of network (three replaceable silane substituents in the monomer) versus linear (two replaceable substituents) siloxane polymers, and (3) the use of either an amide or an ether function to bond the fluoroalkyl group to the polymer backbone. Due to the expense of these fluorinated materials, a study was conducted of the copolymerization of the best fluoroalkyl substituted silanes with much cheaper non-fluorinated alkyl silanes. Among the latter were those with varying alkyl chain lengths and number and orientation of the replaceable silane substituents. The oil and water repellencies obtained with both the homopolymers and copolymers ranged from outstanding to essentially none. Explanations are advanced for the values obtained and literature comparisons are made. GRA

N80-18186# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.

SYNTHESIS CHARACTERIZATION AND MORPHOLOGY OF A CIS 1, 4 POLYISOPRENE/POLY N-BUTYLMETHACRYLATE DIBLOCK COPOLYMER

Robert E. Cohen and Frank S. Bates Dec. 1979 27 p refs
(Contract N00014-77-C-0311; NR Proj. 356-646)
(AD-A078731; TR-4) Avail: NTIS HC A03/MF A01 CSCL 07/3

Homogeneous anionic polymerization methods were employed to synthesize a diblock copolymer of the form (A)(n)-b-(B)(m) in which repeat unit A is isoprene, B is n-butylmethacrylate and b is a single unit of 1,1 diphenylethylene. Various physical-chemical characterization methods were employed to determine that the molecular weights of the A and B blocks are 80,000 and 160,000 g/mole respectively. NMR spectra indicated that the poly n-butylmethacrylate moiety is composed predominantly of syndiotactic triads. Thermal analysis and dynamic mechanical testing were used to determine the polyisoprene and poly n-butylmethacrylate glass transition temperatures, which were around -70 and 20 C respectively; the poly n-butylmethacrylate transition observed in the viscoelastic experiments was unusually broad, covering more than 75 C from onset to completion. Thin films of the diblock copolymer prepared by solvent evaporation casting methods, using a variety of solvents and a wide range of solvent evaporation rates, showed a variety of morphologies in transmission electron micrographs. Most notable among these was a structure obtained in rapid-evaporation castings which contained relatively large regions of homogeneous diblock copolymer embedded in the microphase-separated material. While these homogenized regions remain unchanged indefinitely in the bulk material at room temperature, they tend to decompose to the stable microphase-separated material upon heating or upon addition of solvent. GRA

N80-18187# Aerospace Corp., El Segundo, Calif. Ivan A. Getting Labs.

LONG-TERM THERMAL STABILITY OF SOLITHANE, A CANDIDATE TWT ENCAPSULANT Final Report, 1 Feb. - 30 Sep. 1978

Camille A. Gaulin, Vester L. Knight, and Manfred Buechler Sep. 1979 17 p ref
(Contract F04701-78-C-0079)
(AD-A078832; TR-0079(4402)-1; SAMSO-79-038) Avail: NTIS HC A02/MF A01 CSCL 09/1

In support of traveling-wave tube amplifier tube encapsulant evaluations, a cured sample of Solithane 113 (a polyurethane potting compound supplied by Watkins-Johnson) was exposed to a vacuum-thermal (120 C) environment for 300 hours to determine if channel degradation occurs on such exposure. Degradation was determined qualitatively by sampling into a quadrupole mass spectrometer the gases and vapors produced from the sample and analyzing the spectra of the gases. The resultant spectra indicated significant thermochemical degradation of the polymer under the conditions of the exposure. These results should be factored into deliberations on the choice of encapsulants for TWTA components. Degradation of this kind may markedly affect physical-chemical properties of the material over the long term and should be treated as a potential source of tube failure due to corona discharge. GRA

N80-18188# Oklahoma Univ., Norman. Dept. of Chemistry.

VARIABLE TEMPERATURE 119M SN MOESSBAUER STUDY OF ORGANOTIN - SUBSTITUTED STYRENE MONOMERS AND POLYMERS

K. C. Molloy, J. J. Zuckerman, H. Schumann (Technical Univ. of Berlin), and G. Rodewald (Technical Univ. of Berlin) Oct. 1979 8 p refs Submitted for publication
(Contract N00014-77-C-0432; NR Proj. 053-636)
(AD-A075958; TR-13) Avail: NTIS HC A02/MF A01 CSCL 11/9

Variable temperature 119m Sn Moessbauer spectroscopy can detect the enhanced binding of the tin atom in organotin 1V substituted styrenes on polymerization. GRA

N80-18189# Naval Research Lab., Washington, D. C.

THE NATURE OF STRENGTH CONTROLLING MACHINING FLAWS IN CERAMICS Interim Report

R. W. Rice and J. J. Mecholsky, Jr. 25 Sep. 1979 33 p refs
(AD-A075481; NRL-MR-4077) Avail: NTIS HC A03/MF A01 CSCL 12/2

The nature of machining flaws introduced in a variety of glass, single crystal, and especially poly-crystal bodies are reported, based on fractographic determination of such flaws as the source of mechanical failure. Particular attention is given to grinding where the anisotropy of strength due to the direction of grinding relative to the tensile axis is shown to be due primarily to a dual population of flaws of differing shapes. One set of flaws form approximately, perpendicular and another parallel to the grinding direction. The latter flaws are typically substantially more elongated and often larger than the former and thus give lower strengths for stressing perpendicular to the direction of grinding. Sawing, sanding, and polishing are also shown to result in similar dual flaw populations. The character of flaws are examined as a function of the type of material and machining, as well as specimen size and shape. The latter suggests a limited strength-size effect due to machining flaws. However, the key findings are that machining flaws do not vary greatly with typical variations of machining or material parameters, e.g., composition, grain size, or hardness. GRA

N80-18190# Army Materials Research Agency, Watertown, Mass.

CARBON IMPURITY EFFECT ON THE THERMAL DEGRADATION OF A SI3N4-Y2O3 CERAMIC Final Report

H. Knoch and George E. Gazza May 1979 14 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A075138; AMMRC-TR-79-27) Avail: NTIS HC A02/MF A01 CSCL 11/2

The oxidation behavior of hot-pressed Si3N4-Y2O3 compounds (principally Si3 Y2O3N4, N-melilite) was studied in air between 700 C and 1440 C. It is shown that carbon impurity strongly influences the thermal degradation of these compounds. Oxidation of carbon-containing materials in air at 1000 C leads to high weight gains, severe cracking, and complete destruction of the samples. Nominally carbon-free materials show good oxidation resistance without cracking. GRA

N80-18191# TRW, Inc., Cleveland, Ohio.

ULTRASONIC DETECTION OF SURFACE FLAWS IN GAS TURBINE CERAMICS Final Report, 13 Sep. 1977 - 12 Dec. 1978

Thomas Derkacs and Istvan M. Matay Aug. 1979 137 p refs
(Contract N62269-77-C-0136)
(AD-A076023; TRW-ER-7980-F; NADC-76369-30) Avail: NTIS HC A07/MF A01 CSCL 11/2

A 45 MHz ultrasonic surface wave technique was developed and evaluated for detection of small surface flaws of - 100 microns (0.004 inches) in gas turbine quality ceramics. The surface wave technique, which employs conventional immersion C-scan recording, was evaluated on hot pressed silicon nitride and silicon carbide of two sources each, and also on reaction bonded silicon nitride and sintered silicon carbide. These evaluations included tests on specimens run in a burner rig to simulate the effects on NDE of a gas turbine operating environment. Conventional mechanical tests were also run to verify defect sizes and types and to correlate flexural strength with ultrasonic inspection results. The technique was found to be quite sensitive to surface conditions such as grinding damage, as well as to defects. Flexural strength was correlated qualitatively with the extent of ultrasonic response from machining damage. The sensitivity to defects was found to be limited by the depth of machining damage and the focal spot size of the ultrasonic beam. For the 580 microns (0.023 inch) diameter focal spot size used, the smallest defect verified metallurgically was equivalent to a 30 microns (0.0012 inch) deep semi-circular crack. Specimens run in the burner rig were found to become uninspectable because of fused silica on the surface. Author (GRA)

N80-18192# Rockwell International Science Center, Thousand Oaks, Calif.
MICROSTRUCTURALLY DEVELOPED TOUGHENING MECHANISMS IN CERAMICS: TRANSFORMATION TOUGHENING IN THE Al2O3/ZrO2 COMPOSITE SYSTEM Progress Report, 1 Jun. 1978 - 31 May 1979
F. F. Lange Oct. 1979 29 p refs
(Contract N00014-77-C-0441)
(AD-A076439; SC5117.7TR; TR-7) Avail: NTIS HC A03/MF A01 CSCL 11/2

Three Al2O3/ZrO2 composites series, containing 0, 2, and 7.5 mole percent Y2O3, respectively, were fabricated. For the Al2O3/ZrO2(-2M/oY2O3) series, tetragonal ZrO2 was retained from one end-member to the other. Significant increases in fracture toughness and strength were observed for materials in this system. Strengths decreased with increasing temperature. These results are consistent with previous theoretical predictions. GRA

N80-18193# De Soto, Inc., Des Plaines, Ill.
HIGH SOLIDS COATING SYSTEMS Final Report, 15 Aug. 1977 - 16 Jan. 1979
Gretchen McKay Apr. 1979 95 p
(Contract F33615-77-C-5101; AF Proj. 2422)
(AD-A07' 433; DFR-79-2; AFML-TR-79-4041) Avail: NTIS HC A05/MF A01 CSCL 11/3

The goal of this program is the development of a 65% volume solids, sprayable (airless electrostatic method), polyurethane exterior aircraft coating meeting MIL-C-83286 performance specifications. A high solids coating can significantly reduce solvent emissions and help the Air Force meet EPA/OSHA requirements for reduced environmental pollution and increased work safety. One formulation consisting of a combination of Acryloid AU-568 (oxazolidine), NIAX PCP-0300 (polyol), and Desmodur N-100 (polyisocyanate) exhibited performance properties close to MIL-C-83286. Additional effort is required to simultaneously maximize coating flexibility and solvent (aircraft fluid) resistance. The pot life of the mixed two-package system and the final spray viscosity also must be improved. Potential polyol and polyisocyanate candidates can be successfully screened using concentration-viscosity diagrams. The effects of solvent on solution rheology were greater than expected. GRA

N80-18194# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
SPACE RADIATION EFFECTS ON TEFLON FILMS Interim Report
Henry S. Judeikis Sep. 1979 40 p refs
(Contract F04701-78-C-0079)
(AD-A076613; TR-0079(4672-01)-02; SAMSO-TR-79-070) Avail: NTIS HC A03/MF A01 CSCL 06/18

Degradation of macroscopic physical properties resulting from chemical changes in fluorocarbon polymers exposed to ionizing radiation is reviewed. The effects of temperature, ultraviolet/visible radiation, and dose rate are considered. Of particular interest are property changes that occur on exposure of these materials to simulated space radiation environments. Results from recent space simulation exposure tests are considered in light of these phenomena. General recommendations are made for the application of existing data to spacecraft problems, as well as for the conduct of future space simulation exposure tests. GRA

N80-18195# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EFFECT OF SURFACE EXPOSURE TIME (SET) ON STRENGTH OF ADHESIVE BONDS TO ALUMINUM
Marie C. Ross, Natalia Petrianyk, Elizabeth A. Garnis, Raymond F. Wegman, and David W. Levi Aug. 1979 15 p refs
(AD-A077107; AD-E400356; ARLCD-TR-79009) Avail: NTIS HC A02/MF A01 CSCL 13/8

Surface exposure times (SET) at 23 C and 50% RH for 2024-T3 aluminum subsequently bonded with EC-2214 adhesive did not affect the bond strength for SET up to 30 days. SET at 54 C and 95 + or - 5% RH gave much lower bond strengths that did not further change with increasing SET. The difference in strength is believed to be due to the formation of a hydrated aluminum oxide on the aluminum surface at 54 C and 95 + or - 5% RH. This hydrated oxide functions as a weak boundary layer. GRA

N80-18196# Dayton Univ. Research Inst., Ohio.
ENVIRONMENTAL DURABILITY TESTING OF STRUCTURAL ADHESIVES. PART 3: RELIABOND 500/RELIABOND 398 Interim Technical Report, Jun. - Dec. 1978
D. Robert Askins Wright-Patterson AFB, Ohio AFML Nov. 1979 31 p ref
(Contract F33615-78-C-5002; AF Proj. 7381)
(AD-A078953; UDR-TR-79-24; AFML-TR-78-35-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 11/1

A program has been conducted to investigate the durability of a 350 F (121 C) curing modified epoxy structural adhesive in an elevated temperature, high humidity environment while under stress. Durability was assessed with three different types of environmental exposure. Unstressed lap shear specimens were exposed to both a 140 F (60 C)/95-100% R.H. environment and a 140 F (60 C) water soak and residual strength tests were conducted after various aging intervals. Stressed lap shear specimens were exposed to a 140 F (60 C)/95-100% R.H. environment and time-to-failure recorded. The unstressed agings produced a progressive loss of residual strength and a progressive increase in the amount of adhesive (interfacial) failure with increased aging time. The stressed agings produced times-to-failure at least as long as those previously obtained (AFML-TR-78-35, Part I) for the PL-729-3/PL-728 and AF-143-2/EC-3917 adhesive/primer systems on the same substrates and surface preparations. Had exposure times been extended beyond 2400 hours, the R398/R500 system may have proven more durable than the two previously tested systems. GRA

N80-18197# California Univ., Berkeley. Dept. of Materials Science and Engineering.
ELASTIC/PLASTIC INDENTATION DAMAGE IN CERAMICS. PART 1: THE MEDIAN/RADIAL CRACK SYSTEM. PART 2: A STUDY OF KINK BAND FORMATION IN COMPOSITES Progress Report, 1 Jan. - 1 Dec. 1979
B. R. Lawn, A. G. Evans, D. B. Marshall, and C. H. Hseuh 1 Dec. 1979 63 p refs
(Contract N00014-79-C-0159)
(AD-A078839) Avail: NTIS HC A04/MF A01 CSCL 11/2

A theory for describing the evolution of the median/radial crack system in the far field of sharp-indenter contacts is developed. Analysis is based on a model in which the complex elastic/plastic field beneath the indenter is resolved into elastic and residual components. The elastic component, being reversible, assumes a secondary role in the fracture process: although it does enhance downward (median) extension during the loading half-cycle, it suppresses surface (radial) extension to the extent that significant growth continues during unloading. The residual component accordingly provides the primary driving force for the crack configuration in the final stages of evolution, where the crack tends to near-half-penny geometry. On the hypothesis that the origin of the irreversible field lies in the accommodation of an expanding plastic hardness impression by the surrounding elastic matrix, the ensuing fracture mechanics relations for equilibrium crack growth are found to involve the ratio hardness-to-modulus as well as toughness. Observations of crack evolution in soda-lime glass provide a suitable calibration of indentation coefficients in these relations. GRA

N80-18198# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
APPLICATIONS OF SURFACE ANALYSIS TECHNIQUES TO STUDIES OF ADHESION Final Report, Mar. - Jul. 1979
William L. Baun Sep. 1979 38 p refs
(AF Proj. 2419)
(AD-A077520; AFML-TR-79-4126) Avail: NTIS HC A03/MF A01 CSCL 11/1

The question is often asked, 'which is the best surface chemistry tool for research on adhesive bonding?' This question is difficult to answer because it depends on the aspects of adhesion which is being studied. Often a combination of instruments must be used to take advantage of the strong points of each. In metal-to-metal bonding there are many facets of adhesive/

adherend interaction. Elemental characterization of adherends, especially when composition with depth is desired, is often best accomplished with Auger Electron Spectroscopy (AES). When information of chemical bonding is required, X-Ray Photoelectron Spectroscopy (XPS) is the choice of most workers. Extremely thin layers of material (when first layer surface sensitivity is needed) requires Ion Scattering Spectrometry (ISS). The high sensitivity of Secondary Ion Mass Spectrometry (SIMS) to many elements important in adhesive bonding makes this technique useful, especially coupled with other methods, such as ISS and AES. Modern surface analysis along with Scanning Electron Microscopy (SEM) provides information on failure surfaces to allow unequivocal determination of the mode of failure. Problems such as charging and decomposition under the probing beam are encountered when characterizing the part of the failure surfaces containing the adhesive. GRA

N80-18199# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ENVIRONMENTAL DURABILITY OF THE WELDBOND, FPL AND PABST JOINING SYSTEMS Final Report, 1 Dec. 1977 - 31 May 1979
R. G. Hocker Wright-Patterson AFB, Ohio AFML Jul. 1979 79 p refs
(Contract F33615-76-C-5412)
(AD-A076608; NOR-79-41; AFML-TR-79-4081) Avail: NTIS HC A05/MF A01 CSCL 13/8

This program was conducted as an addendum to Contract No. F33615-76-C-5412, 'Advanced Weldbonding Process Establishment for Aluminum'. Under controlled stress and environmental conditions, a direct comparison of durability and surface corrosion behavior was made for three surface preparation/adhesive systems. These systems included the PABST adhesive bonding system, the FPL adhesive bonding system, and the Northrop weldbond system. The three types of tests used were the wedge test, the constant load-salt water immersion test, and the surface scratch test. Four different environmental exposures were used: (1) 95 to 100 percent relative humidity at 120 F, (2) 5 percent salt fog at 95 F, (3) 3.5 percent salt water and (4) the sea coast beach site at El Segundo, California. Four material combinations were evaluated for this program: 2024-T3 alclad bonded to 7075-T6 bare, 2024-T3 bare bonded to 7075-T6 bare, 2024-T3 bare bonded to 2024-T3 bare, and 7075-T6 bare bonded to 7075-T6 bare. The objective of this program was to rank the three bonding systems and four material combinations in terms of durability and corrosion behavior. GRA

N80-18200# Ecole Nationale Superieure de Techniques Avancees, Paris (France).
STUDY AND TORSION TESTING OF COMPOSITE MATERIALS IN THE FORM OF BARS HAVING RECTANGULAR CROSS-SECTIONS [ETUDE DU TEST DE TORSION DE BARREAUX COMPOSITES A SECTION RECTANGULAIRE]
Chetha Phang and Tat Sinh Vong Dec. 1977 34 p refs In FRENCH
(Contract DGRST-74-7-0747)
(RR-094) Avail: NTIS HC A03/MF A01

The modulus of shear and the elastic limit at shear were evaluated for an orthotropic prismatic bar of composite structure using extensometric measurements of deformation of shear. A tensor analysis of average deformation at shear is presented as a theoretical introduction to the determination of the shear characteristics of a material through strain gage measurement of surface deformation during torsional stress. The experimental setup is described and the processes used in the fabrication of specimens are outlined. Results show good agreement between predicted linear elastic behavior of the bars and measured deformations at failure. Author (ESA)

N80-18201# National Technical Information Service, Springfield, Va.
ADHESIVES: PROPERTIES, PREPARATION, AND APPLICATIONS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 304 p Supersedes NTIS/PS-78/1180; NTIS/PS-77/1060; NTIS/PS-76/0892; NTIS/PS-75/704; NTIS/PS-75/040
(PB80-801855; NTIS/PS-78/1180; NTIS/PS-77/1060; NTIS/PS-76/0892; NTIS/PS-75/704; NTIS/PS-75/040) Avail: NTIS HC $30.00/MF $30.00 CSCL 11A

Studies on polymer chemistry, curing, crosslinking, and synthesis for use as adhesives are cited. The heat resistance, fracture, aging, shear strength, and other physical and mechanical properties of adhesives and sealants are covered, as is the use of adhesives in aircraft, laminates, wood bonding, electronics, and spacecraft. This updated bibliography contains 296 abstracts, 95 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-18202 Oklahoma State Univ., Stillwater.
PHOTOCHEMICAL CONVERSION OF COAL TO GASOLINE IN AN ENTRAINED BED REACTOR Ph.D. Thesis
Muthu Subramanian Sundaram 1979 246 p
Avail: Univ. Microfilms Order No. 8003606

The interaction of photochemically produced hydrogen atoms with a variety of coal dusts under various reaction conditions was investigated. The existence of correlations between coal types and their relative hydrogen atom reactivities as a function of temperature, extent of conversion, particle size, and hydrogen atom concentration was explored. Dissert. Abstr.

N80-18203# Department of the Treasury, Washington, D.C. Bureau of Alcohol, Tobacco and Firearms.
EXPERIMENTAL ALCOHOL FUEL PLANTS
Dec. 1979 27 p
(ATF-P-5000-2) Avail: NTIS HC A03/MF A01

Information on experimental alcohol fuel plants for personal fuel use is presented. Pertinent laws and regulations for the prospective alcohol producers and users are described. R.E.S.

N80-18204# Department of the Treasury, Washington, D.C. Bureau of Alcohol, Tobacco and Firearms.
ALCOHOL FUELS INFORMATION DIRECTORY
Feb. 1980 8 p
(ATF-P-5000-3) Avail: NTIS HC A02/MF A01

Information on renewable energy sources, particularly alcohol fuels, is presented. Permit information is discussed. R.E.S.

N80-18205*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INITIAL CHARACTERIZATION OF AN EXPERIMENTAL REFEREE BROADENED-SPECIFICATION (ERBS) AVIATION TURBINE FUEL
George M. Prok and Gary T. Seng Jan. 1980 10 p refs
(NASA-TM-81440; E-206) Avail: NTIS HC A02/MF A01 CSCL 21D

Characterization data and a hydrocarbon compositional analysis are presented for a research test fuel designated as an experimental referee broadened-specification aviation turbine fuel. This research fuel, which is a special blend of kerosene and hydrotreated catalytic gas oil, is a hypothetical representation of a future fuel should it become necessary to broaden current kerojet specifications. It is used as a reference fuel in research investigations into the effects of fuel property variations on the performance and durability of jet aircraft components, including combustors and fuel systems. J.M.S.

N80-18206# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Labs.
EVALUATION OF JP-5 TURBINE FUEL IN THE SINGLE CYLINDER CUE 1790 DIESEL ENGINE Final Report, Jun. - Nov. 1979
Richard B. Moon Nov. 1979 42 p refs
(Contract DAAK70-79-C-0060)
(AD-A078666; AFLRL-119) Avail: NTIS HC A03/MF A01 CSCL 21/4

The performance test compared fuel consumption and horsepower of the CUE 1970 when operating on JP-5 turbine fuel in place of diesel fuel while the endurance test compared engine wear and deposits when operating the CUE 1790 on JP-5 instead of diesel fuel. The performance test indicated no change in power and a 3 + or - 1 percent increase in fuel consumption. The endurance test indicated no change to slightly less wear, less deposits, no change in the oil consumption rate, and nothing unusual or excessive in the used oil analyses. Analysis of the JP-5 indicated a cetane number within diesel fuel specifications. Although further tests are necessary to define the effect of random variables on the test results, from this test it can be concluded that the use of JP-5 in the CUE 1790 resulted in no appreciable loss in performance or service life. As a result, JP-5 is considered to be a satisfactory alternative fuel for use in the AVDS 1790-2C diesel engine. GRA

N80-18207# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.

PROPELLANT SURVEILLANCE REPORT LGM-30, A, B, F, G, STAGE 1, TP-H1043 AFT CLOSURE PROPELLANT **Semiannual Report**

John A. Thompson Nov. 1979 33 p
(AD-A078778; MANCP-424(79)) Avail: NTIS
HC A03/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1043 propellant representing selected batches used in the aft closure of First Stage Minuteman Motors. Data from TP-H1043 propellant obtained from the aft closures of the LGM-30 A, B, F and G Motors are reported in regression analyses for the fifth time and the fourth time using the G085 computer system. Testing was accomplished in accordance with MMWRM Project M82934C. An analysis of all parameters indicate that no significant degradation is anticipated for at least two years past the oldest data point. Each point on the regression plot represents all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-18208# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.

PROPELLANT SURVEILLANCE REPORT LGM-30 F & G STAGE 1, PHASE E, SERIES 8, TP-H1011 **Semiannual Report**

John A. Thompson Oct. 1979 140 p
(AD-A078777; MANCP-423(79)) Avail: NTIS
HC A07/MF A01 CSCL 21/9

This report contains propellent test results from cartons of TP-H1011 bulk propellant representing LGM-30 F and G First Stage Minuteman Motors. This report uses a statistical approach to analyze the bulk carton propellant data. Testing was accomplished in accordance with MMWRM Project M82934C - WNL 17514. The data from this test period are combined with data from previous testing and entered into the G085 computer for storage, analysis and regression analysis. From the statistical analysis of all data tested to date thirteen and one-half years for F and G, significant degradation of the propellant does not appear likely for at least two years past the oldest data point. Each point on the regression plot represents the mean of all samples at that particular age. The number of samples at each point is indicated on the sample size summary sheet on the page accompanying each regression plot or group of regression plots. The data range at any age can be found by suitable inquiry of the G085 system. GRA

N80-18209# Georgia Inst. of Tech., Atlanta.

THE FIRE ENVIRONMENT OF A SOLID ROCKET PROPELLANT BURNING IN AIR **Final Report**

E. W. Price, W. L. Meyer, W. C. Strahle, S. S. Samant, E. A. Powell, and J. C. Handley Mar. 1979 249 p refs
(Contract F29601-76-C-0119)
(AD-A076941; AD-E200321; AFWL-TR-78-34) Avail: NTIS
HC A11/MF A01 CSCL 21/9

A study was made of the fire environment of UTP 3001 propellant burning at atmospheric pressure in air, with particular emphasis on the conditions likely to affect objects immersed in the fire. The studies involved measurements of conditions using propellant samples with planar burning surfaces from 2 to 120 sq cm. Early tests indicated that deposition of condensed materials was a critical factor in heat-up of immersed objects. Several methods of observation were used to determine temperatures, flow variables, nature of condensed material and spatial distributions of these variables. Analyses were made of chemical equilibrium conditions, burning of aluminum droplets, and of size distribution of condensed materials versus location in the flow. GRA

N80-18210# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.

AN INVESTIGATION OF PARTICLE SIZE DISTRIBUTION USING LASER HOLOGRAPHY OF BURNING SOLID PROPELLANT **Final Report, Nov. 1977 - 30 Sep. 1978**

Michael J. Adams and T. W. Owens Sep. 1979 43 p refs
(AF proj. 2308)
(AD-A078904; AFRPL-TR-79-48) Avail: NTIS
HC A03/MF A01 CSCL 21/2

A test area was modified to allow holographic recordings to be made of burning solid propellant samples as contained in a pressurized window bomb. A holographic reconstruction area was also established. An attempt was made to develop a semi-automated holographic data retrieval (HDR) system using existing AFRPL hardware. The purpose of the HDR system was to retrieve particle size and positions information in a timely manner from holographic reconstructions of the propellant combustion. Experiments with the HDR system revealed serious deficiencies in the areas of resolution and particle recognition. Since a primary goal of the program was to establish particle distribution correlations from holographically derived particle information, the present program has been inactivated pending the development and acquisition of an improved HDR system. GRA

N80-18211# Defence Research Information Centre, Orpington (England).

TESTING FOR HOMOGENEITY OF CHEMICAL COMPOSITION OF SOLID PROPELLANTS BY MEANS OF HPLC

M. Fariwar-Mosheni (Esfahan Univ., West Germany), E. Ripper (Bundesinst. fuer Chem. -Tech. Untersuchungen), J. Zierath (Bundesinst. fuer Chem. -Tech. Untersuchungen) et al Jul. 1979 7 p refs Transl. into ENGLISH from Git Fachzeitschrift fuer das Laboratorium, (West Germany), v. 22, no. 9, 1978 p 781-782
(DRIC-Trans-5685; BR69143) Avail: NTIS HC A02/MF A01

A quantitative analytical method based on high pressure liquid chromatography is described for determining the chemical composition of propellant extracts. The standard deviation and reproducibility of the mean values of the contents were found to be so favorable that the method is suitable for determining inhomogeneities in solid propellants. It also has the advantage of requiring considerably less time than the polarographic methods used for routine purposes in the field of propellant analysis. Author (ESA)

N80-18212# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

HYDROGEN AS A FUEL

L. W. Richards Jul. 1979 35 p refs
(TT-7903; ISSN-0140-9751) Avail: NTIS HC A03/MF A01

Research on the storage of hydrogen in automobiles is reviewed. Metal hydride storage, encapsulation of hydrogen in molecular sieve zeolites, and the reaction of saline hydrides with water are considered in detail. After a brief comparison of hydrogen energy yield with gasoline energy yield per weight, hydrogen fuel storage in motor vehicles is considered. Safety factors of different storage schemes (high pressure gas, cryogenic tanks, metal hydrides) are emphasized along with volume and weight considerations. Results show two basic systems as feasible, namely that of a saline hydride reacting with water inside the vehicle, or a system involving a combination of calcium - mischmetal and magnesium, with nickel to act as a catalyst. Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-18213 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION BULLETIN. PART 4: VIBRATION TESTING, INSTRUMENTATION, LOADS AND ENVIRONMENTS, TRACKED VEHICLES
Sep. 1978 174 p refs Presented at the 48th Symp. on Shock and Vibration, Huntsville, Ala., 18-20 Oct. 1977; sponsored by Army Missile Res. and Develop. Command 4 Vol.
(Bull-48-Pt-4) Avail: NRL, Tech. Inform. Div., Washington, D.C.

Topics are presented on vibration measurement techniques and their reliability in establishing acceptance levels for the structural integrity of missiles, aircraft structure, and solid rocket boosters. For individual titles, see N80-18214 through N80-18230.

N80-18214 Pacific Missile Test Center, Point Mugu, Calif.
A MATHEMATICAL METHOD FOR DETERMINING A LABORATORY SIMULATION OF THE CAPTIVE-FLIGHT VIBRATIONAL ENVIRONMENT c39
Sharon Ogden *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 1-4 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A method for selecting a small number of discrete dynamic pressure (q) levels and associated test time at each level which represents the given captive-flight conditions is described for the PHOENIX missile. M.M.M.

N80-18215 Pacific Missile Test Center, Point Mugu, Calif.
ACOUSTICS OR SHAKERS FOR SIMULATION OF CAPTIVE FLIGHT VIBRATION c39
A. M. Spandrio and M. E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 5-14 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Two methods currently being used to simulate the captive flight vibration loads the PHOENIX missile experiences on the F-14 aircraft are compared. In these programs the PHOENIX T-201 Environmental Measurements Missile was used. This same missile was subjected to captive flight simulation using the dual shaker vibration and acoustical vibration. PHOENIX T-201 was assembled in the same instrumentation configuration during both simulations as it was in the captive flight programs. The excitation of the missile by acoustics more nearly resembled that seen in captive flight than the excitation provided by the dual shakers. Since the acoustic excitation allows the missile to vibrate in three axes simultaneously, the simulation technique becomes far superior when the single axis constraint of shakers is considered. In addition, several test specimens may be placed in the acoustic chamber simultaneously. It was concluded that the use of acoustics for simulation of captive flight vibration demonstrated itself to be an accurate and cost effective test method. M.M.M.

N80-18216 Pacific Missile Test Center, Point Mugu, Calif.
AUTOMATIC ENVIRONMENTAL CONTROL SYSTEM FOR MISSION PROFILE TESTING c35
Robert Schilken *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 15-23 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A simple and inexpensive Automatic Environmental Control System was developed for controlling realistic mission profile environmental tests. Hardwired logic and reprogrammable electronic storage were used in the general purpose control system. Coding techniques and a random number generator for simulating temperature day variations in the mission are presented. The entire thermoacoustic environmental generation facility used for missile captive flight simulation is described including a newly developed high efficiency noise modulator driver. Author

N80-18217 Harris Corp., Melbourne, Fla. Electronic Systems Div.
BROAD-BAND MECHANICAL VIBRATION AMPLIFIER c35
R. T. Fandrich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 25-31 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The mechanical system described amplifies vibration inputs at frequencies above the system isolation frequency (80 Hertz). It effectively amplified input vibration levels by a factor of 3 g's/g over an input frequency range of 100 to 2000 Hz, allowing testing at 150 g's while driving the shaker at only 60 g's, thereby saving energy and high level wear and tear on the shaker system and extending the upper limit of feasible test levels. M.M.M.

N80-18218 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
STABILITY AND FREQUENCY RESPONSE OF HYDROMECHANICAL SHAKERS IN VIBRATION RIGS c35
T. Seshadri Sankar *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 33-47 refs Sponsored by the Natl. Res. Council of Canada and the Formation de Chercheurs et d'Action Contertee (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An analytical study on the stability and frequency response of hydromechanical shakers used for generating vibrational signals to drive a vibration rig is presented. The analytical expressions for stability are derived based on linearized flow characteristic equations and taking into account the effect of fluid inertance and resistance in the connecting pipes. It was shown that the size of the connecting pipes and their elasticity influence the stability of the shaker. Simple expressions are derived for the amplitude ratio and phase angle against frequency for both open and closed loop frequency response of the hydromechanical shaker based on Duffing's linearization scheme. The analytical expressions derived for stability and frequency response can be directly used for selecting and/or specifying the hydromechanical shaker which best meets a given set of requirements. M.M.M.

N80-18219 Harris Corp., Melbourne, Fla. Electronic Systems Div.
MIL-STD-781C RANDOM RELIABILITY TESTING PERFORMED BY USING ACOUSTIC COUPLING c35
S. M. Landre *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 49-56 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

An approach for performing random vibration during reliability testing by using an acoustic coupled shaker system is described. It employs a speaker, a flat plate fixture, a hi-fi amplifier, and a hi-fi tape recorder capable of playing a tape loop. Laboratory experiments on the model to evaluate its performance and potential are presented. M.M.M.

N80-18220 Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
CONSERVATISM IN RANDOM VIBRATION ANALYSIS AND TESTING c39
Thomas L. Paez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 57-70 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Some measures of confidence in specified test levels are proposed. A technique is described for finding the probability that a test is more severe than the field environment from which it was derived. A mean square structural response criterion is used. It was shown that a laboratory random vibration test is most likely to fail when the structure being tested has lightly damped, low frequency modes, and when the test duration is short. M.M.M.

N80-18221 Boeing Aerospace Co., Seattle, Wash.
INCANDESCENT LAMP LIFE UNDER RANDOM VIBRATION c33
Clark J. Beck, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 71-81 refs

(For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Several sets of incandescent lamps were subjected to random vibration in order to generate a curve of lamp life versus vibration level. The vibration levels were varied from 0.02 G sq/Hz to 1.6 G sq/Hz. Each set of lamps was vibrated until all lamps failed or for a maximum time of 2-1/2 hours. The tests were conducted with lamps energized and not energized. The test results show that average operational life of a lamp under random vibration differs significantly from lamp rated life. M.M.M.

N80-18222 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANGULAR VIBRATION MEASUREMENT TECHNIQUES c35
P. Wayne Whaley and Michael W. Obal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 83-93 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Six angular vibration sensors are evaluated in light of the requirements for measuring angular vibrations of aircraft structures in order to describe optical package disturbances. In addition, experience with differential angular vibration measurement using conventional accelerometers is presented and evaluated. These results indicate a strong need to develop a good, reliable, miniature angular vibration sensor for airborne measurements. K.L.

N80-18223 Monash Univ., Clayton (Australia).
HIGH FREQUENCY GROUND VIBRATION MEASUREMENT c39
H. Nolle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 95-103 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The basic requirements for vibration transducer-to-ground coupling to ensure linear measuring system response are reviewed. Results are presented from field tests of different designs for ground attachments, and recommendations are made for procedures of ground attachment installation in different soil types and rock formations. The techniques are demonstrated with reference to some of the results of vibration surveys of three different railway track installations. K.L.

N80-18224 Bouche Labs., Sun Valley, Calif.
THE RECIPROCITY CALIBRATION OF VIBRATION STANDARDS OVER AN EXTENDED FREQUENCY RANGE c39
R. R. Bouche *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 105-111 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Reciprocity calibrations are performed at various frequencies up to 10,000 Hz using an air-breathing shaker with a built-in primary standard accelerometer. The shaker is used for sensitivity and frequency response calibrations on other accelerometers and velocity pickups in the range of 10 Hz to 10,000 Hz and up to 50,000 Hz for resonance frequency calibrations. Author

N80-18225 Sandia Labs., Albuquerque, N. Mex.
A NON-CONTRACTING BETA BACKSCATTER GAGE FOR EXPLOSIVE QUANTITY MEASUREMENT c35
P. B. Higgins, F. H. Mathews, and R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 113-126 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A noncontracting method of measuring the quantity of light initiable explosive previously applied to a surface is described. Design parameters, calibration procedures, and field results are given for a beta backscatter gage which measures the areal density of a layer of the primary explosive, silver acetylide-silver nitrate (SASN), on a carbon or aluminum subsurface. The radiation patterns produced by the gage using three different beta source geometries are determined and their relative merits are discussed. K.L.

N80-18226 Air Force Weapons Lab., Kirtland AFB, N. Mex. Civil Engineering Research Div.
DATA ACQUISITION FOR THE IMMEDIATE FUTURE c35
Josef F. Schneider *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 127-137 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The problem of acquiring transient data in an extremely hostile environment is addressed. An analog multiplex system that transmits data in real time and requires analog type recording is considered along with a system that multiplexes on the digital side. The data is stored digitally and plotted for quick-look analysis without the need for precomputer data reduction. Application guides and formulae are given for each system, and a comparison is presented which lists respective system merit parameters for similar data handling requirements. K.L.

N80-18227 Pacific Missile Test Center, Point Mugu, Calif.
THE VIBRATION RESPONSE OF THE PHOENIX MISSILE IN THE F-14 AIRCRAFT CAPTIVE-FLIGHT ENVIRONMENT c15
Marsha E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 139-150 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The vibration response characteristics of the PHOENIX missile on the F-14 aircraft in the captive high environment is investigated. Variations in vibration response with flight condition, mounting configuration, direction, and location along the length of the missile are examined. The conclusions are: (1) vibration response in externally carried stores is directly proportional to dynamic pressure except in the transonic region where an increase in vibration occurs; (2) vibration response varies with platform configuration with an increase occurring with additional externally carried stores in the flow fields; and (3) vibration response is most severe in the after section and in the vertical and lateral direction of the externally carried stores. K.L.

N80-18228 Naval Weapons Center, China Lake, Calif.
SOME DYNAMIC RESPONSE ENVIRONMENTAL MEASUREMENTS OF VARIOUS TACTICAL WEAPONS c15
W. W. Parmenter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 151-158 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

Pertinent results of several environmental dynamic measurement programs for widely diverse types of tactical weapons are reported. Spectra are included for the SLUFAE weapon mounted on a tracked vehicle, the ASROC missile mounted within launcher cells and magazines of various classes of ships, the FAE-II and GATOR free-fall weapons captive-flown on A-7 and AV-8 aircraft, the Condor weapon captive-flown on an A-6 aircraft, and the MAD-FAE weapon dispenser system suspended beneath a CH-53 helicopter. The character of the dynamic environments during weapon deployment is briefly discussed. K.L.

N80-18229 McDonnell-Douglas Astronautics Co., St. Louis, Mo.
TURBULENT-BOUNDARY-LAYER EXCITATION AND RESPONSE THERETO FOR A HIGH-PERFORMANCE CONICAL VEHICLE c06
C. M. Ailman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 159-169 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

A compiled data bank for describing the fluctuating pressures that force the shell of a non-maneuvering reentry vehicle to vibrate during reentry is presented, the use of local aerodynamic parameter values for the cone when predicting these pressures is discussed, and the characteristics of shell-mode vibration peculiar to a conical structure with a multilayered skin are described. Flight data are reported for such a structure maneuvering as a result of flow disturbance at the aft end. The data suggest some angle of attack dependencies not previously detected, and indicate low frequency response of the vehicle as a beam. The beam response is analytically examined as to its probable cause. K.L.

N80-18230 Hercules, Inc., Magna, Utah.
CALCULATION OF ATTACH POINT LOADS DUE TO POSSIBLE COMBUSTION INSTABILITY IN THE SPACE

SHUTTLE SOLID ROCKET BOOSTERS c20
F. R. Jensen and D. T. Wang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 171-174 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

The structural response of the Space Shuttle vehicle to possible acoustic combustion instability in the solid rocket boosters was analyzed. The response of the vehicle to pressure oscillations in the solid rocket boosters (SRB's) was calculated in terms of forces and displacements at the attach points between the SRB's and the External Tank (ET), and between the ET and the orbiter. The NASTRAN computer program was used to analyze various finite element shuttle models. A detailed finite element model of the solid rocket motor was constructed for use with the cyclic symmetry option in NASTRAN. The models were analyzed separately and results were combined to represent the total structure by using a mechanical impedance type approach. K.L.

N80-18231* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF PRODUCING SILICON Patent
Charles B. Wolf (Westinghouse Electric Corp., Trafford, Pa.) and Thomas N. Meyer, inventors (to NASA) (Westinghouse Electric Corp., Trafford, Pa.) Issued 12 Feb. 1980 6 p Filed 29 Mar. 1978 Supersedes N78-22186 (16 - 13, p 1678) Sponsored by NASA
(NASA-Case-NPO-14382-1; US-Patent-4,188,368;
US-Patent-Appl-SN-891373; US-Patent-Class-423-350;
US-Patent-Class-261-118; US-Patent-Class-422-224) Avail: US Patent and Trademark Office CSCL 13H

A liquid reactant injector assembly suited for the injection of liquid reactant into a high temperature metal reductant vapor and carrier gas stream for the production of metal is presented. The assembly is especially adapted for the continuous production of high purity silicon by the reduction of SiCl4 with sodium. The assembly includes a refractory-lined, hollow metal shell having ten equally-spaced, concentric, radially directed ports provided in the shell and wall. A hydraulic, atomizing type spray nozzle is mounted in each of the ports recessed from the inner wall surface. Official Gazette of the U.S. Patent Office

N80-18232 Texas A&M Univ., College Station.
STRUCTURAL EVALUATION OF RECYCLED PAVEMENT MATERIALS, VOLUMES 1 AND 2 Ph.D. Thesis
Dallas Neville Little, Jr. 1979 713 p
Avail: Univ. Microfilms Order No. 8003161

The principles of rational pavement analysis were used together with in situ nondestructive testing to evaluate the structural performance of recycled pavement materials under load. The recycled layers were compared to the conventional pavement layers of the AASHTO Road Test by means of The AASHTO structural layer coefficient. These coefficients describe the relative structural contribution of an asphalt concrete surface, a crushed stone base, and a gravel subbase to the pavement system. A rational technique utilizing nonlinear layered elastic theory and characterization of recycled asphalt bound materials in terms of resilient modulus as a function of temperature was used to develop structural coefficients for the recycled materials. The response of the recycled layer was compared to a reference layer of conventional construction at the same location using the stiffness equivalency factor concept. The results proved the recycled surfaces and bases to be generally stiffer and superior in terms of their ability to favorably distribute harmful stresses and strains than the conventional materials. Dissert. Abstr.

N80-18233 Pittsburgh Univ., Pa.
PREDICTION AND STATISTICAL ANALYSIS OF SETTLEMENTS OF SHALLOW FOUNDATIONS ON SAND Ph.D. Thesis
Michel Ragi R. Elias 1979 151 p
Avail: Univ. Microfilms Order No. 8004848

A proposed settlement formulation based on the theory of elasticity and the equivalent corrected blow counts is used to calculate the ratio, r, of measured settlements to calculated settlements of 67 shallow foundations on sand. The error in predicting settlement as estimated by the variance indicates that the proposed method results in an improvement over two recognized methods. The proposed method is considered to be consistent, and more reliable in the sense that the variance and uncertainty in the predicted settlements are known and can be accounted for. A hypothetical project involving the design of foundations on sand, from the standpoint of settlement considerations, is presented to illustrate a procedure of optimizing the total expected settlement related cost of the project, C sub T, which is expressed as a function of the number of test borings. In the optimization process, the optimum number of test borings that would minimize C sub T is determined. Dissert. Abstr.

N80-18234 Illinois Univ. at Urbana-Champaign.
RESILIENT BASED FLEXIBLE PAVEMENT DESIGN PROCEDURE FOR SECONDARY ROADS Ph.D. Thesis
Jose Ludwig Figueroa 1979 334 p
Avail: Univ. Microfilms Order No. 8004168

Easy to use and reliable algorithms to predict the resilient response of flexible pavements in terms of material properties and layer thicknesses are developed based on the data generated from a modified finite element program and an elastic layer stress-dependent program. Other research objectives are: (1) to establish the significance of subgrade resilient properties in determining pavement response to load; (2) to establish the significance of the damage caused to the pavement by loads applied during periods of critical subgrade support; (3) to study the influence on pavement response of using different types of granular base materials and to examine the possibility of developing thickness equivalence factors; and (4) to study the influences of base material shear strength on the development of failure zones within the pavement cross-section and on the pavement response to load. Dissert. Abstr.

N80-18235 Illinois Univ. at Urbana-Champaign.
RESISTANCE OF REINFORCED CONCRETE STRUCTURES UNDER HIGH INTENSITY LOADS Ph.D. Thesis
Theodor Krauthammer 1979 230 p
Avail: Univ. Microfilms Order No. 8004210

The resistance of reinforced concrete structural members subjected to high intensity loads such as that arising from a nuclear detonation, is studied for cases in which an equivalent static design approach can be employed as a basis for the proportioning of the structural components. A modified procedure for analyzing and designing reinforced concrete beams is developed. The method provides a basis for assessing the influence of the shearing reinforcement on the ultimate moment capacity of the beams. The procedure is employed to analyze simply supported reinforced concrete slender and deep beams and the results are compared to the experimental data. Dissert. Abstr.

N80-18236 Illinois Univ. at Urbana-Champaign.
A STUDY OF LOCAL MINIMA IN STRUCTURAL DESIGN Ph.D. Thesis
Bernardo Horowitz 1979 197 p
Avail: Univ. Microfilms Order No. 8004191

Structural design optimization problems are addressed. Design problems involving simple structural configurations amenable to graphical representation are discussed. The results obtained for those examples suggest that each local minimum corresponds to a specific way in which the structure may carry the applied loads. This motivates the concept of load carrying mechanisms. In order to be able to handle larger problems, an algorithm is developed which seeks to ensure convergence to a possible local minimum corresponding to the intended mode of behavior. For the case of single loads and stress constraints only, it is shown that the Lagrange multipliers represent the gradient vector of the functional that expresses the objective function in terms of the maximum member stresses. The method is applied to symmetric plane frames made up of prismatic members where the objective function is the total volume of material. Examples of structures subjected to single loading conditions and stress constraints only are studied to verify the generality of the concept of load carrying mechanisms. Dissert. Abstr.

N80-18237 Texas A&M Univ., College Station.
BEARING CAPACITY OF DRIVEN PILES IN SAND Ph.D. Thesis
Reno Reine Castello 1979 151 p
Avail: Univ. Microfilms Order No. 8003113

The unit point and side resistances obtained from thirty-four field pile load tests were used to determine which of the pile geometry and soil parameters are most significant. Bearing capacity factors are calculated and correlated with the most significant pile-soil system parameters. Three types of load test data are used: compression test data adjusted for residual stresses, unadjusted compression test data and compression/tension test data. The best and simplest correlations are developed by plotting the bearing capacity factors versus the relative depth, i.e., the depth of penetration to diameter ratio. An error analysis of these correlations provides the basis for the conclusion that both unadjusted compression and compression/tension test correlations yield fairly accurate predictions (usually within ±20%) for total bearing capacity. However, the compression/tension test correlations give the best predictions for point and side bearing capacity. Dissert. Abstr.

N80-18238 Massachusetts Univ., Amherst.
A STUDY OF THE STRUCTURE OF LIQUID HELIUM BY X-RAY SCATTERING Ph.D. Thesis
Howard Neil Robkoff 1979 263 p
Avail: Univ. Microfilms Order No. 8004980

The static structure factor of liquid He-4 was systematically measured over a wide range of temperature, pressure and momentum transfer, using a high intensity precision cryogenic X-ray diffractometer. The data at small momentum transfer extrapolate smoothly to the thermodynamic value for the k intercept. Generally, the effect of increasing the density at constant temperature is to heighten and sharpen the structure factor peak and displace it to slightly larger values of k. Agreement with the previous neutron measurements at elevated pressure by Mozer et al is excellent. A comparison with recent theoretical calculations for elevated pressure at OK reveals a sharper status structure factor peak in the experimental results. The effect of lowering the temperature at constant density is found to be an increase in the structure factor peak height up to the lambda transition. Further cooling is observed to result in a small but distinct decrement in structure. This decrease in structure persists to the lowest temperature studied. Dissert. Abstr.

N80-18239 Illinois Univ. at Urbana-Champaign.
EXPERIMENTAL STUDY OF FRAME-WALL INTERACTION IN REINFORCED CONCRETE STRUCTURES SUBJECTED TO STRONG EARTHQUAKE MOTIONS Ph.D. Thesis
Daniel Paul Abrams 1979 400 p
Avail: Univ. Microfilms Order No. 8004118

The response of reinforced concrete structures subjected to earthquake motions was studied. Reinforced concrete model structures were subjected to simulated earthquake motions. Each ten-story structure comprised two frames resisting lateral inertial loads in parallel with one slender structural wall. Geometry of each structure was the same, however, reinforcement was varied according to different concepts of intended behavior. Measurements at each level included accelerations, displacements, and forces resisted by wall. Strength of members was established according to a design method that recognized energy dissipation capabilities of reinforced concrete structures in the nonlinear range of response. A linear analytical model with arbitrarily softened members was used to estimate maximum response. Dissert. Abstr.

N80-18240 Illinois Univ. at Urbana-Champaign.
RESPONSE OF TEN STORY, REINFORCED CONCRETE MODEL FRAMES TO SIMULATED EARTHQUAKES Ph.D. Thesis
Haluk Cecen 1979 353 p
Avail: Univ. Microfilms Order No. 8004149

The elastic and inelastic response of reinforced concrete structures subjected to strong earthquake excitations was investigated for two identical test structures which were subjected to different numbers and intensities of base motions (principal variables of these tests). All the base motions were patterned after the El Centro-NS, 1940 earthquake. The original earthquake time scale was compressed by a factor, k = 2.5, in order to excite the test models in a way that would be compatible with the excitation of actual structures by real earthquakes. Several analytical methods and structural idealizations were evaluated by comparing the response calculated by them with the observed response of the test structures. A special formulation of a general method was used in an attempt to determine apparent member stiffness distributions at selected instants of a given response history. Dissert. Abstr.

N80-18241 Lehigh Univ., Bethlehem, Pa.
ANALYSIS AND DESIGN OF STEEL BEAM-TO-COLUMN WEB CONNECTIONS Ph.D. Thesis
Glenn Paul Bentschler 1979 390 p
Avail: Univ. Microfilms Order No. 8003068

Web connections were studied relative to their elastic behavior with regard to stiffness, stress distribution, and stress concentrations. The primary analytical tool used was the finite element method. Also included were experimental tests involving web connection details as well as web connection beam and column assemblages. Two types of connections were studied: (1) a connection where the beam flange is attached to the column via a flange connection plate which is welded or bolted to the beam flange and welded to the column flanges; and (2) a connection in which the beam flange is welded directly to the column web. Procedures are outlined for predicting the elastic stiffness of such connections. Dissert. Abstr.

N80-18242 Oklahoma State Univ., Stillwater.
A STUDY OF FLEXIBLE PAVEMENT CRACK DYNAMICS AND SEALANTS Ph.D. Thesis
Ismail Mouhamed Bash 1979 162 p
Avail: Univ. Microfilms Order No. 8003556

Laboratory test procedures for predicting field performance of flexible pavement crack sealing materials were evaluated. In addition, a field study of crack movements and behavior under varying load and temperature conditions was conducted in order to establish criteria for sealant performance based on average conditions on Oklahoma pavements. The bond-ductility test was found to offer the basic evaluative procedure for crack sealing materials. The rubberized asphalt was superior to the other tested sealants. The asphalt cements and the emulsions were found to be too stiff to withstand crack simulated straining actions. The geological formation underlying the pavement had an effect on subsequent cracking of the pavement and cracking behavior. The relative vertical displacement of the crack sides, which indicates the sealant shear strain, was approximately 10 percent of the horizontal crack movement. Dissert. Abstr.

N80-18243# Illinois Univ., Urbana. Dept. of Civil Engineering.
LONGITUDINAL JOINT SYSTEMS IN SLIP-FORMED RIGID PAVEMENTS. VOLUME 3: USER'S MANUAL Interim Report
Amir M. Tabatabaie and Ernest J. Barenberg Nov. 1979 76 p
(Contract DOT-FH-11-874)
(AD-A078850; FAA-RD-79-4-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 13/2

The computer program described, can be used for the analysis of a number of problems which can be summarized as follows: (1) concrete pavements with load transfer systems at the joints; (2) jointed reinforced concrete pavements with cracks having reinforcement steel at the cracks; (3) continuously reinforced concrete pavements; (4) concrete shoulders with or without the bars; (5) concrete pavements with a stabilized base or an overlay and assuming either a perfect bond or no bond between two layers; and (6) concrete slabs of varying thicknesses and modulus of elasticities, and subgrades with varying modulus of supports. A.R.H.

N80-18244*# National Aeronautics and Space Administration, Washington, D. C.
DEBURRING DIE-CASTINGS BY WET VIBRATORY PLANT
Hans-Martin Loeschbart Feb. 1980 11 p ref Transl. into ENGLISH from Geisserei (West Germany), v. 58, no. 1, 14 Jan. 1971, p 6-9 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75755) Avail: NTIS HC A02/MF A01 CSCL 13H

A wet vibratory procedure for the removal of burrs from die castings is described. In this process synthetic abrasive chips and detergent solutions are agitated with the work in such a way as to produce a spiral circulatory movement. Details of various forms of vibrator basin and shapes of abrasive are illustrated. The automation of deburring is illustrated through the application of vibrators of spiral design in combination with transport and drying devices. M.G.

N80-18245*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ROLE OF THE MICRO ENVIRONMENT ON THE TRIBOLOGICAL BEHAVIOR OF MATERIALS
Donald H. Buckley 1980 13 p refs Proposed for presentation at Ann. Meeting of the Inst. of Environ. Sci., Philadelphia, 11-14 May 1980
(NASA-TM-81434; E-358) Avail: NTIS HC A02/MF A01 CSCL 20K

The properties of the environment which exert an influence upon adhesion, friction, wear, and lubrication of materials in solid state contact are discussed. The effect of the environment upon lubricants and lubricant properties is considered in relation to the interaction of the lubricant with the material surfaces in solid state contact and the ability of lubricants to provide protective surface films. J.M.S.

N80-18246# Centre Technique des Industries Mecaniques, Senlis (France).
THE INFLUENCE ON SPARK MACHINING EFFICIENCY OF THE TECHNIQUE FOR INDUCING DIELECTRIC CIRCULATION BETWEEN THE WORK MATERIAL AND THE ELECTRODE Final Report [INFLUENCE DU MODE DE CIRCULATION DU DIELECTRIQUE ENTRE LA PIECE ET L'ELECTRODE SUR LE RENDEMENT DE L'USINAGE PAR ELECTRO EROSION]
Dixmier 30 Nov. 1979 106 p In FRENCH
(CETIM-13-G-03-0) Avail: NTIS HC A06/MF A01

Dielectric circulation techniques in electro-erosion machining are reviewed. Several alternatives are discussed and practical rules of the selection of the optimum dielectric circulation technique for each case are given. The discussion includes the case of passing-through cavities, the influence of electrode shape and material, optimization of flow, and aspiration flow systems. It is shown that there are low and high limits to the acceptable dielectric flow and practical rules for the maximum length of dielectric circulation in the electrode gap are derived.
Author (ESA)

N80-18247# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.
COST MINIMIZATION CALCULATIONS FOR PLANE AND THREE DIMENSIONAL FRAME STRUCTURES [RECHNERGESTUETZTER ENTWURF ZUR KOSTENMINIMIERUNG EBENER UND RAEUMLICHER FACHWERKE]
Ulrich Breitling 1978 99 p refs In GERMAN
(ILR-39; ISBN-3-7983-0655-9; ISSN-0341-0587) Avail: NTIS HC A05/MF A01

The concept of nonlinear concave goal functions are applied to cost optimizing structural calculations. Difficulties arise in employing the functions due to the lack of means simplifying and quantifying economic factors and technical details concerning fabrication. Applications of the method are shown for such three dimensional structures as bridges and roofs. Author (ESA)

N80-18248# Texas Transportation Inst., College Station.
METHODOLOGY FOR PREDICTING THE REFLECTION CRACKING LIFE OF ASPHALT CONCRETE OVERLAYS Interim Report, Sep. 1974 - Mar. 1979
Frederick P. Germann and Robert L. Lytton Mar. 1979 151 p refs Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin
(PB80-101710; TTI-2-8-75-207-5; FHWA/TX-79-09-207-5) Avail: NTIS HC A08/MF A01 CSCL 13B

An experimental testing procedure was established, for quantitative analysis of overlays designed to reduce reflection cracking. From this testing procedure the overlay scheme that shows the most resistance to cracking can be chosen. The procedure uses crack propagation tests on overlay samples which are conducted on a machine called the overlay tester. This machine was specifically built to stimulate the displacements resulting from temperature changes in the cracked or jointed pavement or base materials that are beneath an overlay. Various types of overlay samples were investigated on the overlay tester. These include samples with fabric, such as 'Petromat', and samples composed of different grades of asphalt. GRA

N80-18249# Transportation Research Board, Washington, D.C.
PAVEMENT DISTRESS, EVALUATION, AND PERFORMANCE
Michael I. Darter, Scott A. LaCoursiere, Scott A. Smiley, J. Brent Rauhut, Freddy L. Roberts et al 1979 83 p refs
(PB80-101991; TRB/TRR-715; ISBN-0-3090-2962-7; LC-79-607814) Avail: NTIS HC A05/MF A01 CSCL 13B

The topics presented deal with the following areas: (1) structural distress mechanisms in continuously reinforced concrete pavement; (2) response and distress models for pavement studies; (3) distresses and related material properties for premium pavements; (4) evaluation of permanent deformation in asphalt concrete pavements; (5) subjective and mechanical estimations of pavement serviceability for rural-urban road networks; (6) quantifying pavement serviceability as it is judged by highway users; (7) measuring pavement performance by using statistical sampling techniques; (8) laboratory testing of a full-scale pavement: the Danish road-testing machine; (9) utility decision model for pavement recycling; and (10) seasonal and short-term variations in skid resistance. GRA

N80-18250# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
TEXTURING OF CONCRETE PAVEMENTS Final Report, Jun. 1973 - Aug. 1979
Sheldon M. Law and Masood Rasoulian Aug. 1979 54 p refs
(PB80-106032; RR-134; FHWA/LA-79-134) Avail: NTIS HC A04/MF A01 CSCL 13B

Research was conducted to document and evaluate the Category 2 Experimental Concrete Texturing project. Several texturing techniques, were tried and compared in order to determine which concrete pavement texture would perform best in regard to skid resistance, durability non hydroplaning properties, noise levels and uniformity. Initially transverse metal tines produced the highest skid number and the best speed gradient. It was recommended that the texturing technique of a longitudinal burlap drag followed by metal tines applied transversely to the centerline of the concrete pavement, be continued as standard on all new concrete pavements and bridge decks. GRA

N80-18251# National Technical Information Service, Springfield, Va.
CRYOGENIC REFRIGERATION, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1977 - Nov. 1979
William E. Reed Dec. 1979 133 p Supersedes NTIS/PS-78/1262; NTIS/PS-77/1158; NTIS/PS-76/0871; NTIS/PS-75/826
(PB80-802051; NTIS/PS-78/1262; NTIS/PS-77/1158; NTIS/PS-76/0871; NTIS/PS-75/826) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Topics in the cited reports include cryogenic cooling of electronic equipment, infrared equipment, cryogenic storage vessels, magnetohydrodynamic generators, and superconducting magnets, coils, rotating machinery, and transmission lines. Marine refrigeration of liquefied natural gas, cryogenic heat pipes, cryogenic heat transfer, and space applications are studied. Methods investigated include adiabatic demagnetization, electrocaloric effect, Joule-Thomson effect, thermoelectric cooling, and Crayton, Claude, Gifford-McMahon, Sterling, and Vuilleumier cycles. This updated bibliography contains 125 abstracts, 48 of which are new entries to the previous edition. GRA

N80-18066*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OPERATION OF JOULE-THOMPSON REFRIGERATION ABOVE THE CRITICAL PRESSURE OF HELIUM
D. L. Johnson *In its* The Deep Space Network 15 Feb. 1980 p 41-49 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20L

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N80-18252* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH-SPEED DATA LINK FOR MODERATE DISTANCES AND NOISY ENVIRONMENTS Patent
Michael W. Sievers, inventor (to NASA) (JPL) Issued 5 Feb. 1980 10 p Filed 25 Apr. 1978 Supersedes N79-24212 (17 - 15, p 1968) Sponsored by NASA
(NASA-Case-NPO-14152-1; US-Patent-4,187,394;
US-Patent-Appl-SN-899828; US-Patent-Class-178-58R;
US-Patent-Class-179-15BA) Avail: U.S. Patent and Trademark Office CSCL 17B

A full duplex, high speed data link is described which comprises identical modules at each site for communication over coaxial cables. Each module having a digital frequency modulation (DFM) transmitter with an first-in-first-out (FIFO) data buffer for data from a digital system to be transmitted over a cable and a receiver with an FIFO data buffer for data received for a digital system at the other end of the cable. Data words are preceded by a sync word which enables the receiver. Every word transmitted, including the sync word is stored in the FIFO data buffer. This arrangement using FIFO buffers allows for asynchronous transmission of data with receipt of the data beginning with the very first bit of the sync word.

Official Gazette of the U.S. Patent and Trademark Office

N80-18253* National Aeronautics and Space Administration. Pasadena Office, Calif.
RADIO FREQUENCY ARRAYING METHOD FOR RECEIVERS Patent
Milton H. Brockman (JPL) and Mahlon F. Easterling, inventors (to NASA) (JPL) Issued 29 Jan. 1980 15 p Filed 31 Oct. 1978 Supersedes N79-14272 (17 - 05, p 0585) Sponsored by NASA
(NASA-Case-NPO-14328-1; NASA-Case-NPO-14579-1;
NASA-Case-NPO-14590-1; US-Patent-4,186,347;
US-Patent-Appl-SN-956160; US-Patent-Class-325-305;
US-Patent-Class-325-307; US-Patent-Class-325-419) Avail: US Patent and Trademark Office CSCL 17B

A method and apparatus for increasing the signal to noise ratio of a receiving facility for coherent frequency reception by arraying receiving systems using separate antennas for each, or one antenna for all systems are presented. One system is operated with a carrier tracking loop to provide a first local oscillator frequency for the first and all other systems arrayed, with individual tracking loops in all other systems operated at IF for tracking out any phase differences due to separate group delays using an adjustable phase shifter for a second reference to compensate for different group delays in the antenna and low noise amplifier of each of the other systems. The second IF output of all systems is summed into the first system. This technique may also be used when two systems are arrayed to an antenna designed for circular or linear polarization diversity reception to effectively provide the same signal to noise ratio for both polarized signal transmission channels that would result from matched polarization. An arrangement adapted to high rate telemetry reception is disclosed. With additional components, the same arrangement is adapted to provide low rate telemetry reception as well.

Official Gazette of the U.S. Patent and Trademark Office

N80-18254 Illinois Univ. at Urbana-Champaign.
ANALYSIS OF ARBITRARILY SHAPED WIRE ANTENNAS RADIATING OVER A LOSSY HALF-SPACE Ph.D. Thesis
Parviz Parhami 1979 136 p
Avail: Univ. Microfilms Order No. 8004249

The problem of an arbitrarily oriented current element over a lossy half space is analyzed. Various numerical approaches are developed and discussed for evaluating the infinite Sommerfeld integrals appearing in the vector potential expressions. In particular, a technique based on the steepest descent path integration is introduced for exact evaluation of these integrals, and, as an efficient alternative, an additional technique is developed based on approximating the well behaved Fourier transform expressions of the Sommerfeld integrals. The latter technique has the merit of not requiring any time consuming infinite integrations and, at the same time, is shown to yield accurate results for a wide range of parameters of practical interest. Finally, the thin wire antenna problem over a lossy half space is analyzed via the method of moments and the current element solution techniques discussed earlier.

Dissert. Abstr.

N80-18255 California Univ., Santa Barbara.
EVALUATION AND IMPROVEMENTS TO THE QUALITY AND INTELLIGIBILITY OF LINEAR PREDICTION VOICE CODING Ph.D. Thesis
David Yee-Yan Wong 1979 281 p
Avail: Univ. Microfilms Order No. 8003040

Linear prediction (LP) voice coding is discussed. The causes of the loss in speech quality are studied and techniques for improvements are explored. Low bit rate speech coding is attained with LP voice coding because of the explicit use of a linear speech model. The validity of the linear model and the accuracy with which its parameters are estimated by the LP algorithms are examined. From this examination, a number of problem areas which lead to quality degradation are defined. An evaluation is conducted to correlate the problem areas with the perceived quality defects in the vocoded speech. The evaluation consists of careful listening and analysis of speech samples produced by two different LP vocoder programs followed by a series of short experiments. Based on the preliminary evaluation, a study on the application of a more realistic excitation pulse for synthesizing voiced speech is conducted. A least squares technique for extracting the glottal volume velocity waveform from the speech waveform is developed and applied to several speech samples.

Dissert. Abstr.

N80-18256 Syracuse Univ., N. Y.
ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT OF ARBITRARY CROSS SECTION IN A CONDUCTING PLANE OF FINITE THICKNESS Ph.D. Thesis
David Thomas Auckland 1979 137 p
Avail: Univ. Microfilms Order No. 8004485

Electromagnetic transmission through a filled slit in a conducting plane of finite thickness was investigated when the slit cross sections was an arbitrary shape. A non-modal formulation was developed whereby the original problem was broken up, via the equivalence principle, into three isolated situations. An integral equation was written for each of these situations involving equivalent electric and magnetic currents as unknowns on the closed contour defining the slit cross section. These three integral equations were solved simultaneously and it is shown that they have a unique solution at all frequencies. A modal solution was also developed for the case when the slit cross section can be viewed as a sequence of two dimensional rectangular cavities, each coupled to the other by an aperture. Results obtained from these two solutions are compared.

Dissert. Abstr.

N80-18257 Kansas Univ., Lawrence.
RADAR IMAGE SIMULATION: A PROJECT TO DEVELOP A MODEL, DEFINE ITS OPERATIONAL CONSTRAINTS, VALIDATE ITS ACCURACY, AND TO PRODUCE SAMPLE RESULTS, VOLUME 1 AND 2 Ph.D. Thesis
Verne Henry Kaupp 1979 552 p
Avail: Univ. Microfilms Order No. 8002808

A radar image simulation project was conducted to develop a model, to define its operational constraints, to validate its accuracy, and to produce sample results. Two different approaches to simulation of radar imagery were evaluated and resulted in two distinct models. The first of these models, the point scattering method (PSM), is applicable to simulation of area extensive, distributed targets. The second, the area spatial filtering (ASF) method, is applicable to simulation of specular reflection, cultural targets. Theoretical developments for both models are summarized, implementations are discussed, and sample results are presented. In addition, several ancillary studies performed in support of simulation are presented.

Dissert. Abstr.

N80-18258# Northeastern Univ., Boston, Mass. Electronics Research Lab.

FM TRANSMISSION OF TELEVISION FROM ROCKETS AND BALLOONS Interim Report

Willard F. Thorn 11 Jul. 1979 58 p refs
(Contracts F19628-76-C-0111; F19628-76-C-0152; AF Proj. 7659)
(AD-A075489; SCIENTIFIC-3; AFGL-TR-79-0160) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report deals with the use of preemphasis filtering in FM transmission of television. The television cameras and transmitter are to be located on rocket or balloon instrumentation payloads. The large RF bandwidth necessary for television transmission requires a large transmitted power for the distances of interest. The use of preemphasis will reduce the required transmitted power considerably below that required for a picture of similar quality without preemphasis. This thesis shows how preemphasis filtering can provide an improvement and what the limits of these improvements are. GRA

N80-18259# Institute for Telecommunication Sciences, Boulder, Colo.

COMPARISON OF MEASURED DATA WITH IF-77 PROPAGATION MODEL PREDICTIONS Final Report

M. E. Johnson and G. D. Gierhart Aug. 1979 443 p refs
(Contracts DOT-FA78WAI-840; DOT-FA68WAI-145)
(AD-A076508; FAA-RD-79-9) Avail: NTIS HC A19/MF A01 CSCL 20/14

Measured propagation data were compared with predictions made by the IF-77 (ITS-FAA-77) and other propagation models. Although IF-77 was developed for aeronautical applications, it can be used for some point-to-point propagation paths, and the measured data selected for comparison includes point-to-point as well as aeronautical paths. Approximately 870,000 hours of data are associated with the 242 paths used. Predictions made with IF-77 were always best or second best and were substantially better than those made for free space conditions. The IF-77 model has a wide range of application and provides predictions compatible with the more specialized models tested. The aeronautical propagation data pool from which the data were selected is an appendix. A.R.H.

N80-18260# Communications Research Centre, Ottawa (Ontario). Technology and Systems Branch.

PICTURE DESCRIPTION INSTRUCTIONS (PDI) FOR THE TELIDON VIDEOTEX SYSTEM

H. G. Bown, C. D. OBrien, W. Sawchuk, and J. R. Storey Nov. 1979 74 p
(CRC-TN-699-E) Avail: NTIS HC A04/MF A01

The Telidon Videotex system is a method by which information is accessed from central data bases by the general public. By the use of a domestic home television receiver augmented by a microcomputer controlled interface device a user can access pages of graphical and textual information over a public common carrier communications facility such as the telephone network, a cable television line, or in a broadcast television signal. A coding scheme which encodes a picture into the geometric drawing elements which compose it is described. The picture description instructions are an alpha geometric coding model and are based on the primitives of POINT, LINE, ARC, RECTANGLE, POLYGON, point by point BIT encoded images, and TEXT encoded as ASCII characters. A detailed specification of the code as well as a description of the principles which make it independent of communications channel and display hardware is provided. A.W.H.

N80-18261*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A FLUORESCENT RADIATION CONVERTER Patent Application

Walter Viehmann, inventor (to NASA) Filed 11 Jan. 1980 19 p
(NASA-Case-GSC-12528-1; US-Patent-Appl-SN-111439) Avail: NTIS HC A02/MF A01 CSCL 20N

A fluorescent radiation converter having a substantially undoped optically transparent substrate and a waveshifter coating deposited on at least one portion of substrate for absorption of radiation and conversion thereof to fluorescent radiation is described. The coating is formed of substantially 1000 g/liter of a solvent, 70 to 200 g/liter of an organic polymer, and .2 to 25 g/liter of at least one organic fluorescent dye. The incoming incident radiation impinges on the coating and enters therein. Radiation is absorbed by the fluorescent dye and is reemitted as a longer wavelength radiation. Advantages of the fluorescent radiation converter in the areas of liquid crystal displays, scintillation counters, and in photovoltaic conversion techniques are discussed. NASA

N80-18262*# International Telephone and Telegraph Corp., New York.

THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 1: EXECUTIVE SUMMARY

R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 50 p 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159619) Avail: NTIS HC A03/MF A01 CSCL 17B

Demand for telecommunications services is forecasted for the period 1980-2000, with particular reference to that portion of the demand associated with satellite communications. Overall demand for telecommunications is predicted to increase by a factor of five over the period studied and the satellite portion of demand will increase even more rapidly. Traffic demand is separately estimated for voice, video, and data services and is also described as a function of distance traveled and city size. The satellite component of projected demand is compared with the capacity available in the C and Ku satellite bands and it is projected that new satellite technology and the implementation of Ka band transmission will be needed in the decade of the 1990's. Author

N80-18263*# International Telephone and Telegraph Corp., New York.

THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 2: MAIN REPORT

R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 309 p refs 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159620) Avail: NTIS HC A14/MF A01 CSCL 17B

A forecast of demand for telecommunications services through the year 2000 is presented with particular reference to demand for satellite communications. Estimates of demand are provided for voice, video, and data services and for various subcategories of these services. The results are converted to a common digital measure in terms of terabits per year and aggregated to obtain total demand projections. J.M.S.

N80-18264*# International Telephone and Telegraph Corp., New York.

THE 30/20 GHz FIXED COMMUNICATIONS SYSTEMS SERVICE DEMAND ASSESSMENT. VOLUME 3: ANNEX

R. B. Gamble, H. R. Seltzer, K. M. Speter, and M. Westheimer Aug. 1979 63 p 3 Vol.
(Contract NAS3-21366)
(NASA-CR-159621) Avail: NTIS HC A04/MF A01 CSCL 17B

A review of studies forecasting the communication market in the United States is given. The applicability of these forecasts to assessment of demand for the 30/20 GHz fixed communications system is analyzed. Costs for the 30/20 satellite trunking systems are presented and compared with the cost of terrestrial communications. J.M.S.

N80-18265# Communications Research Centre, Ottawa (Ontario).

SYSTEM-DESIGN CONSIDERATION FOR AN OPTICAL CORRELATOR FOR THE SEASAT-A SYNTHETIC-APERTURE RADAR

E. B. Felstead Apr. 1979 81 p refs
(AD-A071358; CRC-1321) Avail: NTIS HC A05/MF A01 CSCL 17/9

System-design considerations are presented for an optical correlator that processes signals recorded on film from the synthetic-aperture radar of the SEASAT-A satellite. A strip-map image of the Earth's surface is to be produced with a resolution down to 6.5 m along track (azimuth) and 25 m across track (range). The input film and the two-dimensional Fourier transform are described mathematically and their parameters given. Processing problems introduced by range curvature, antenna pitch and yaw, earth rotation, low PRF, etc., are handled by simple modifications to a standard tilted-plane correlator. Recommended system configurations, output parameters and system limitations are given. GRA

N80-18266# Arcon Corp., Waltham, Mass.
MATHEMATICAL ANALYSIS AND PROGRAMMING AS APPLIED TO ELECTROMAGNETIC PROPAGATION AND ANTENNA DESIGN Final Report, 28 Sep. 1976 - 30 Jun. 1978
John OBrien, Ilya Koltunov, Peter Wintersteiner, and Benzion Guz Jun. 1979 122 p
(Contract F19628-76-C-0310; AF Proj. 9993)
(AD-A076150; RADC-TR-79-146) Avail: NTIS HC A06/MF A01 CSCL 20/14

In this report, the analysis and programming for various problems in the field of Electromagnetic propagation and antenna design are considered. The scope of our work extended into a variety of technical areas. Among the technical areas are: Magneto-acoustic surface waves, Signal analysis, Polar VLF propagation, Ionospheric pulse reflections, Detection and tracking of targets, and Antenna Design. GRA

N80-18267# Naval Research Lab., Washington, D. C.
RADAR SURVEILLANCE/RADAR TRACKING VARIANT TO SPEARS
Mar. 1979 75 p Revised
(AD-A076147; NRL-7958-Rev) Avail: NTIS HC A04/MF A01 CSCL 17/9

The AAW performance simulation designated SPEARS (System Performance Evaluation and Requirements Simulation) now exists in a version which contains extensive revisions in the areas of radar surveillance and radar tracking. To upgrade the capability of the SPEARS simulation of shipboard radar surveillance, a detailed radar-surveillance model designated SURSEM (Surveillance Radar Systems Evaluation Model) has been modified and incorporated into SPEARS. In addition, a simple tracking algorithm has also been added to replace the implicit assumption that a target track is established instantaneously upon initial detection and then carried automatically until the target either leaves the radar's coverage volume or terminates its flight. Due to time and financial constraints, this version of SPEARS has undergone only limited testing at present. GRA

N80-18268# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE USE OF LINEAR PREDICTION FOR THE INTERPOLATION AND EXTRAPOLATION OF MISSING DATA AND DATA GAPS PRIOR TO SPECTRAL ANALYSIS
Stephen B. Bowling and Shu T. Lai 18 Jun. 1979 23 p refs
(Contract F19628-78-C-0002)
(AD-A075515; TN-1979-46; ESD-TR-79-160) Avail: NTIS HC A02/MF A01 CSCL 12/1

The spectral analysis of a series of equally spaced samples of a time-stationary process becomes difficult when samples are missing or sizable data gaps occur within the interval of interest. A linear prediction algorithm can be used to fill in the missing data with estimates that are spectrally consistent with the data that are observed. Simulated and practical radar examples demonstrate an improvement in resolution and a reduction of sidelobe interference levels. Computer programs are provided which accomplish the extrapolation and interpolation for complex data. GRA

N80-18269# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
STIMULATED - EMISSION - OF - ENERGETIC - PARTICLES (SEEP) EXPERIMENT Final Report
Sep. 1979 28 p refs
(Contract N00014-78-C-0755)
(AD-A075503; LMSC-D678462) Avail: NTIS HC A03/MF A01 CSCL 20/14

The immediate scientific objective of this stimulated-emission-of-energetic-particles (SEEP) program is to experimentally establish the detailed relationship between ground-based VLF transmitter activity (i.e., operating frequency, signal strength, pulse duration and duty cycle) and the characteristics of the resulting particle precipitation (intensity, energy and pitch angle distribution). Once these relationships are established an assessment can be made of the feasibility of using controlled wave-particle interactions as a selective method of precipitating electrons from the radiation belts onto critical communication links in the ionosphere. With this knowledge corrective actions to mitigate the effects of such activity against existing and planned U.S. Navy communication systems can be pursued. GRA

N80-18270# Stanford Univ., Calif. Electronics Labs.
ELF SFERIC OCCURRENCES IN THE ANTARCTIC DURING A SOLAR PROTON EVENT CASE STUDY OF OCCURENCES AT BYRD STATION DURING THE EVENT 9 JUNE 1968 Final Report, 1 Dec. 1977 - 30 Nov. 1978
A. C. Fraser-Smith and R. A. Helliwell 19 Sep. 1979 45 p refs
(Contract DNA001-78-C-0017)
(AD-A078923; AD-E300634; SU-SEL-79-005; DNA-4911F) Avail: NTIS HC A03/MF A01 CSCL 04/1

Electromagnetic waves with frequencies above the extremely-low-frequency range (ELF: frequencies in the range 5 Hz-3) are susceptible to a variety of solar proton event (SPE) effects when propagating through a polar region in the earth-ionosphere waveguide. These effects appear to become less severe as the frequency of the waves becomes smaller and approaches the ELF range. Although measurements have been lacking, it would be expected that ELF wave propagation through the polar regions would be comparatively stable. To investigate polar ELF wave propagation during an SPE, we have carried out a series of measurements of the properties of ELF sferics (75 Hz) at a polar location (Byrd Station, Antarctica) during a moderately-large SPE. These measurements suggest that an SPE can significantly alter the characteristics of ELF signals propagating through the polar regions: during the first 24 hours of the SPE there was a reduction of about 50% in the median amplitudes of the sferics, compared with their amplitudes before the SPE, and there were substantial changes in their rates of occurrence. GRA

N80-18271# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
MILLIMETER WAVE HARDENED ANTENNA WINDOW MATERIALS DEVELOPMENT Final Report, Jul. 1978 - Apr. 1979
James P. Brazel, Richard Fenton, John A. Roetling, and Richard A. Tanzilli Aug. 1979 275 p refs
(Contract DAAG46-79-C-0047; DA Proj. 8X3-63304-D-215)
(AD-A076769; AMMRC-TR-79-45) Avail: NTIS HC A12/MF A01 CSCL 17/5

A materials development and characterization program has been conducted with the goal of developing hardened antenna window materials for application to millimeter wave and infrared sensors for ballistic missile defense interceptor (BMDI) applications. Three distinct classes of materials were studied. The ADL-4D6 multidirectionally reinforced silica-silica composite developed in previous BMD work was tested for particle erosion resistance and dielectric properties in the mm wavelength region. A comprehensive study was also performed on the effects of constituent properties and weaving and composite densification variations on the mechanical properties of this material. A second class of refractory dielectrics, ultrahigh purity nitrides of silicon and aluminum, were also examined for their ultimate potential in the BMDI environment. Specimens were prepared by chemical vapor deposition and hot pressing of powders. These were variously tested for mechanical and thermal properties, chemical purity and dielectric properties in X and millimeter wavelength bands. The CVD Si3N4 material in particular showed a decade lower loss tangent than previously reported versions of this ceramic. A third material, 'Raytran' zinc selenide, an infrared window material candidate, was characterized for its thermophysical and mechanical properties from -150 C to 1000 C. GRA

N80-18272# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
STUDIES OF EQUATORIAL SCINTILLATION PROBLEMS Final Report, 21 Jun. 1976 - 30 Sep. 1979
K. C. Yeh and C. H. Liu Sep. 1979 235 p refs
(Grants DAAG29-76-G-0286; DAAG29-78-G-0101)
(AD-A076622; UILU-eng-79-2559; TR-65; ARO-14260-8-ELX)
Avail: NTIS HC A11/MF A01 CSCL 20/14

This report describes the experimental set-up, observations and results of satellite radio signals received at an equatorial station. The effects of dispersion and scattering of a pulse propagating through the ionosphere are also investigated theoretically. GRA

N80-18273# Harry Diamond Labs., Adelphi, Md.
THE EMP RESPONSE OF A SYSTEM OF UNCOUPLED, INTERCONNECTED CABLES
Robert F. Gray Oct. 1979 21 p
(DA Proj. 1L1-62120-AH-25)
(AD-A077659; HDL-TR-1903) Avail: NTIS HC A02/MF A01 CSCL 20/14

An approximate analytical technique is developed for the electromagnetic pulse (EMP) response of a complex system of cables deployed over a real earth. The technique involves an existing transmission-line solution for the EMP response of a cable which is extended to a system of interconnected but uncoupled cables by the principle of superposition. The complete response of one particular cable is found by replacing all the other cables connected to it with equivalent Thevenin sources. The response of the cable due to the EMP and the equivalent sources are then summed. The equivalent Thevenin sources are developed from the existing transmission-line solution for the EMP response of a single cable. Experimental verification of the applicability of the superposition principle to transmission lines is also given. GRA

N80-18274# Ohio State Univ. Research Foundation, Columbus. Dept. of Engineering Mechanics.
RECENT DEVELOPMENTS IN CLASSICAL WAVE SCATTERING - FOCUS ON THE T-MATRIX APPROACH Final Report, 1 Dec. 1978 - 30 Sep. 1979
Vijay K. Varadan, ed., Vasundara V. Varadan, ed. et al Aug. 1979 570 p refs Presented at the Intern. Symp., Columbus, Ohio, 25-27 Jun. 1979
(Contract N00014-79-C-0111)
(AD-A077579; OSURF-761454/711671) Avail: NTIS HC A24/MF A01 CSCL 20/11

Contents: T-Matrix Approach--Single Scattering; T-Matrix Approach--Multiple Scattering; Computational Aspects of T-Matrix, Comparison with other Methods; Moment Methods; Geometrical Theory of Diffraction; Resonances and Singularity Expansions; Finite Element Method; Multiple Scattering Theories; Experimental Methods and Inverse Scattering Analyses; and Special Topics. GRA

N80-18275# Ohio State Univ. Research Foundation, Columbus. Dept. of Engineering Mechanics.
MULTIPLE SCATTERING OF ACOUSTIC, ELECTROMAGNETIC AND ELASTIC WAVES
Vijay K. Varadan Sep. 1979 33 p refs
(Contract N00014-78-C-0559; Grant NOAA-04-78-B01-21)
(AD-A077577; OSURF-761261/711400;
OSURF-761251/711374) Avail: NTIS HC A03/MF A01 CSCL 20/11

In this article we present a multiple scattering analysis of the coherent wave propagation through an inhomogeneous medium consisting of either random or periodic distribution of scatterers of arbitrary shape. Both specific and random orientations of the scatterers are considered. The mathematical unity inherently present in the T-matrix formalism for the three wave fields, namely acoustic, electromagnetic and elastic, is employed in conjunction with suitable averaging procedures to formulate a self-consistent multiple scattering theory. For a random distribution of scatterers we use a configurational averaging procedure, while for a periodic distribution, we use a suitable lattice sum based on crystallographic theory. The information about the orientation of the scatterers has been incorporated into the T-matrix of the scatterer itself thus making formalism a convenient computational scheme to study the anisotropic effects in an inhomogeneous medium. The statistically averaged equations obtained by the analysis are then solved by using Lax's quasicrystalline approximation to obtain the bulk or effective properties of the medium. Numerical results are presented for propagation speeds, attenuation and frequency dependent elastic properties for a range of frequencies to demonstrate the broad applicability of the T-matrix method. GRA

N80-18276# American Electronic Labs., Inc., Farmingdale, N.J.
ELECTROMAGNETIC RADIATION SYSTEM (EMRS) FOR SUSCEPTIBILITY TESTING Quarterly Report, 1 Jan. - 31 Mar. 1979
Margaretta V. Stone Aug. 1979 11 p
(Contract DAAB07-76-C-0332; DA Proj. 1L7-62701-AH-92)
(AD-A076953; CORADCOM-76-0332-10) Avail: NTIS HC A02/MF A01 CSCL 14/2

The function of the Electromagnetic Radiation System (EMRS) is to generate electromagnetic energy to produce a constant field strength that can be automatically scanned as a function of frequency. The design objective is to cover the frequency range of 30 Hz to 40 GHz with field intensities up to 200 volts per meter. This report describes system equipment status and results of performance tests in the demonstration frequency ranges of 30-60 MHz, 1.0-2.1 GHz, 2.1-4.0 GHz and 12.4-18.0 GHz. GRA

N80-18277# Science Applications, Inc., El Segundo, Calif.
HARDENED RADAR COMPONENT MATERIALS DEVELOPMENT STUDY Final Report, 28 May 1978 - 30 Jan. 1979
Irving Osofsky and Robert Semelsberger May 1979 255 p refs
(Contract DAAG46-78-C-0052; DA Proj. 8X3-63304-D-215)
(AD-A077805; AMMRC-TR-79-34) Avail: NTIS HC A12/MF A01 CSCL 17/9

A combined analytical and experimental study was conducted to identify and evaluate materials for protecting Ballistic Missile Defense system ground radar components from nuclear thermal radiation damage. This program included thermal testing using the French Solar Furnace and the SAI Thermal Radiation Simulator, electrical property tests at the Georgia Institute of Technology, Engineering Experiment Station, and planning of mechanical property tests to be conducted in the BMD Materials Test facility at AMMRC. Materials included bulk ceramics, ceramic coatings and bulk ablators. The results indicated promise for the use of a silicone rubber ablator and uninfiltrated porous ceramic coatings for radar component thermal hardening. Further tests and analyses are recommended for these classes of materials in order to evaluate the effect on radar performance. GRA

N80-18278# ITT Gilfillan, Inc., Van Nuys, Calif.
SIGNAL PROCESSING FOR UNATTENDED RADAR Final Technical Report, Sep. 1978 - Feb. 1979
John M. Milan, Robert H. Fletcher, Jr., Charles D. Lucas, Jr., and Jack W. Goodwin Griffiss AFB, N.Y. RADC Oct. 1979 174 p ref
(Contract F30602-78-C-0288; AF Proj. 4506)
(AD-A078478; RADC-TR-79-243) Avail: NTIS HC A08/MF A01 CSCL 17/9

This final report documents the results of a six-month study conducted during phase 1 of a contract to examine Signal Processing for Unattended Radars. Based on a general set of system and processor requirements for a representative unattended radar, various signal processing operations, architectures, and technologies are evaluated. A recommended signal processor is identified, and the selection rationale is presented. The principle selection criteria are those of reliability, performance, cost, maintainability, risk and power consumption. The major risk areas in the selected processor have been identified and a validation plan proposed for phase 2 of the SPUR effort. This plan consists of recommended approaches, including a formal test plan, for reducing these risks. GRA

N80-18279# Mission Research Corp., Santa Barbara, Calif.
THE SENSITIVITY OF SATELLITE COMMUNICATIONS TO THE UNCERTAINTIES IN SELECTED CHEMICAL REACTION RATE COEFFICIENTS Final Report, Apr. 1977 - Feb. 1979

Murray Scheibe 31 May 1979 55 p refs
(Contract DNA001-77-C-0224)
(AD-A078924; AD-E300633; MRC-R-458; DNA-4971F) Avail: NTIS HC A04/MF A01 CSCL 20/14

The relative importance of various reaction rates are examined using the results of a recent MELT code calculation for a megaton range burst at 250 km altitude. New rate coefficients are developed for the critical reactions involved in the ion decay and the uncertainties in these rate coefficients are examined. With the use of a number of assumptions, some of them rather crude, these rate coefficient uncertainties are translated into uncertainties in communications degradation effects for HF and higher frequencies and some of these are significant. Areas in which improvement is needed, with regard to both reaction rate data and the chemistry treatment in MELT, are noted. GRA

N80-18280# Research Inst. of National Defence, Linkoeping (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH Si-IMPATT DIODE AMPLIFIER. VOLUME 1: TEXT
Herbert Steyskal Mar. 1979 77 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30154-E1-Vol-1) HC A04/MF A01

The construction of a MIC transceiver module is reported. Test methods for transmitter and receiver branches are described and test results are reported with emphasis on phase stability as a function of temperature, voltage, and time. Test results for icw drift of single IMPATT diode amplifier stages are given, e.g., intrapulse phase shift. Author (ESA)

N80-18281# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH Si-IMPATT DIODE AMPLIFIER. VOLUME 2: FIGURES AND TABLES [X-BANDS GRUPPANTENNMODUL MED Si-IMPATT DIODFOERSTAERKARE. DEL 2: FIGURER OCH TABELLER]
Herbert Steyskal Mar. 1979 52 p In SWEDISH 2 Vol.
(FOA-C-30154-E1-Vol-2) Avail: NTIS HC A04/MF A01

Figures and tables are presented for the test results of the transmitter and receiver branches of a MIC tranceiver module. Phase stability is emphasized in terms of temperature, voltage, and time. Graphic data is also given for the icw drift of a single IMPATT diode amplifier. Author (ESA)

N80-18282# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH GaAs IMPATT DIODE AMPLIFIER. VOLUME 1: TEXT
Herbert Steyskal Apr. 1979 76 p refs In SWEDISH; ENGLISH summary 2 Vol.
(FOA-C-30155-E1-Vol-1) Avail: NTIS HC A05/MF A01

The construction of a MIC twin transceiver module is described. It contains three stage GaAs IMPATT diode amplifiers with 1 W cw output and 20 dB gain at 9 GHz, analog ferrite phase shifters, PIN-diode switches, and balanced mixers. Test methods for transmitter and receiver branches are described and test results broken down into transmitter, receiver, and control elements characteristics are reported. Emphasis is on phase data as functions of temperature, voltage, and time. Phase and amplitude tracking at constant voltage or constant current were measured for a changing ambient temperature. The ICW operation of the transmitter branches on low duty cycle was tested and results concerning amplification and intrapulse phases shift are discussed. Author (ESA)

N80-18283# Research Inst. of National Defence, Stockholm (Sweden).
AN X-BAND ARRAY ANTENNA MODULE WITH GaAs IMPATT DIODE AMPLIFIER. VOLUME 2: FIGURES AND TABLES [X-BANDS GRUPPANTENNMODUL MED GaAs IMPATT DIODFOERSTAERKARE. DEL 2: FIGURER OCH TABELLER]
Herbert Steyskal Apr. 1979 48 p In SWEDISH 2 Vol.
(FOA-C-30155-E1-Vol-2) Avail: NTIS HC A03/MF A01

Table and figures are presented for the test results of the transmitter and receiver branches of a MIC twin module. Author (ESA)

N80-18284# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Telecomunicacion.
CONTRIBUTIONS OF OPTIMAL RECEIVER THEORY TO DIGITAL EQUALIZATION [APORTACION DE LA TEORIA DEL RECEPTOR OPTIMO A LA IGUALACION DIGITAL]
Jesus Rivero Laguna 1979 58 p refs In SPANISH
(ETSI-04-176) Avail: NTIS HC A04/MF A01

Data transmission through telephonic channels was analyzed with emphasis on optimal receiver theory. An optimized analog filter structure was studied and its influence on the received signal was determined. The modifications derived from the insertion of a digital filter were surveyed and optimal detection algorithms were examined. It is concluded that the equalization of the telephonic channel for data transmission can be reduced to the design of a digital filter, leaving out the nonlinear optimal detectors if the intersymbol interference is not too strong. Author (ESA)

N80-18065*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VALIDATION OF ROUNDTRIP CHARGED-PARTICLE CALIBRATIONS DERIVED FROM S- AND X-BAND DOPPLER VIA DRVID MEASUREMENTS
D. W. Green *In its* The Deep Space Network 15 Feb. 1980 p 30-40 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20N

N80-18066*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE PRACTICAL LIMITS OF PHOTON COMMUNICATION
R. J. McEliece, E. R. Rodemich, and A. L. Rubin *In its* The Deep Space Network 15 Feb. 1980 p 63-67 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

N80-18073*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VITERBI DECODING MODIFIED FOR SOURCES WITH MEMORY
V. Kopwar *In its* The Deep Space Network 15 Feb. 1980 p 97-110 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 17B

N80-18464*# Centre National d'Etudes des Telecommunications, Lannion (France). Dept. Mesures Ionospheriques et Radioelectriques.
THE FRENCH SHORT TERM RADIOPROPAGATION PREDICTIONS IN THE DECAMETER BAND
P. Lassudrie-Duchesne, A. M. Bourdila, and H. Sizun *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 12-24 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18465*# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).
PROPAGATION PREDICTIONS FOR THE HF-RANGE BY THE RESEARCH INSTITUTE OF THE DEUTSCHE BUNDESPOST
Th. Damboldt *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 25-43 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18468*# Polish Academy of Sciences, Warsaw. Space Research Centre.
ESTIMATION OF SOLAR FLAME INFLUENCE ON RADIO CIRCUIT TRANSMISSION LOSS
Z. Klos and K. Stasiewicz *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 67-71 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18472*# National Physical Lab., New Delhi (India). Radio Science Div.
LONG TERM SOLAR ACTIVITY AND IONOSPHERIC PREDICTION SERVICES RENDERED BY THE NATIONAL PHYSICAL LABORATORY, NEW DELHI

B. M. Reddy, S. Aggarwal, D. R. Lakshmi, S. Shastri, and A. P. Mitra *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 118-133 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18478*# Radio Research Labs., Nakaminato (Japan).
FORECASTS OF GEOMAGNETIC ACTIVITIES AND HF RADIO PROPAGATION CONDITIONS MADE AT HIRAISO/ JAPAN
K. Marubashi, Y. Miyamoto, T. Kidokoro, and T. Ishii *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 182-204 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18480*# Radio Research Labs., Tokyo (Japan).
RADIO PROPAGATION PREDICTION SERVICES IN JAPAN
Rikio Maeda *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 212-222 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18481*# Radio Research Labs., Tokyo (Japan).
RADIO DISTURBANCE WARNING ISSUANCE SYSTEM
Rikio Maeda and Hisao Inuki *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 223-228 (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

N80-18488*# Naval Ocean Systems Center, San Diego, Calif.
PROPHET: AN APPLICATON OF PROPAGATION FORECASTING PRINCIPLES
Paul E. Argo and Ilan J. Rothmuller *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 312-321 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N80-18285* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH POWER RF COAXIAL SWITCH Patent
Edward R. Caro, inventor (to NASA) (JPL) Issued 5 Feb. 1980 6 p Filed 10 Oct. 1978 Continuation of abandoned U.S. Patent Appl. SN-835419, filed 21 Sep. 1977 Sponsored by NASA
(NASA-Case-NPO-14229-1; US-Patent-4,187,416;
US-Patent-Appl-SN-949886; US-Patent-Class-200-153S;
US-Patent-Class-200-304; US-Patent-Class-333-262;
US-Patent-Appl-SN-835419) Avail: US Patent and Trademark Office CSCL 09A

A coaxial switch capable of operating in a vacuum with high RF power in the 1.2 GHz range without multipactor breakdown, and without relying on pressurization with an inert gas is described. The RF carrying conductors of the switch are surrounded with a high grade solid dielectric, thus eliminating any gaps in which electrons can accelerate.

Official Gazette of the U.S. Patent and Trademark Office

N80-18286* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOLTAGE FEED THROUGH APPARATUS HAVING REDUCED PARTIAL DISCHARGE Patent
Stephen R. Peck (GE, Philadelphia) and Jeffrey W. Benham, inventors (to NASA) (GE, Philadelphia) Issued 22 Jan. 1980 5 p Filed 10 Jan. 1978 Supersedes N78-17297 (16 - 8, p 1013) Sponsored by NASA
(NASA-Case-GSC-12347-1; US-Patent-4,185,164;
US-Patent-Appl-SN-868249; US-Patent-Class-174-142;
US-Patent-Class-174-73R) Avail: US Patent and Trademark Office CSCL 09A

A voltage feed-through apparatus, having reduced partial discharge, has an electrical conductor and an electrical terminal connected thereto. A semiconductor sleeve surrounds the conductor for reducing the electric field concentration at the metallic conductor surface and consequently reducing the partial discharge occurrences. An insulator sleeve encircles the semiconductor sleeve. A metallic sleeve surrounds a portion of the terminal. Another insulator is connected to the metallic sleeve and surrounds a portion of the insulator sleeve forming a space therebetween. Another metallic sleeve spaced from the first metallic sleeve surrounds a portion of the other insulator.

Official Gazette of the U.S. Patent and Trademark Office

N80-18287* National Aeronautics and Space Administration. Pasadena Office, Calif.
MICROWAVE POWER TRANSMISSION BEAM SAFETY SYSTEM Patent
Richard M. Dickinson, inventor (to NASA) (JPL) Issued 5 Feb. 1980 8 p Filed 16 Oct. 1978 Supersedes N79-10271 (17 - 01, p 0036) Sponsored by NASA
(NASA-Case-NPO-14224-1; US-Patent-4,187,506;
US-Patent-Appl-SN-951829; US-Patent-Class-343-100R;
US-Patent-Class-310-306; US-Patent-Class-343-100ST) Avail: US Patent and Trademark Office CSCL 09C

A system in which the characteristics of a microwave power transmission beam are controlled in accordance with power distribution profiles altered due to the detected presence or entrance of an object into the beam which causes changes that are perceived in various received, reflected and scattered power distribution profiles resulting over various receiving elements of the system is presented. The system comprises a microwave power beam radiator array, a microwave power beam receiving antenna array, the radiator array in one embodiment being located on an orbiting spacecraft and the receiving array being located at a ground station. Another embodiment provides a ground based transmitting array and a receiving array aboard an aircraft or airship.

Official Gazette of the U.S. Patent and Trademark Office

N80-18288 Illinois Univ. at Urbana-Champaign.
DETECTION, ESTIMATION, AND ORDER REDUCTION IN MULTIPARAMETER SINGULARLY PERTURBED SYSTEMS Ph.D. Thesis
Dean Altshuler 1979 105 p
Avail: Univ. Microfilms Order No. 8004123

The problem of state estimation for the slow modes of a hierarchial singularly perturbed system is considered. A detection estimation approach is derived which obtains near optimal estimates in the presence of multiple perturbation parameter uncertainties. The scheme is of most value when the estimation problem is one of a steady state nature. However, small sample performance is analytically derived. Since the algorithm always contains a near optimal filter corresponding to the unknown perturbation parameters, questions of convergence need not be considered. A second problem that is addressed is that of obtaining a steady state slow mode estimate when the perturbation parameter is not small. It is shown that in many cases, a near optimal solution exists that is easily implementable. Its performance, in general, is superior to the reduced filter, yet its complexity is comparable. Dissert. Abstr.

N80-18289 Illinois Univ. at Urbana-Champaign.
THE DYNAMIC STABILITY OF PERMANENT-MAGNET STEP MOTORS Ph.D. Thesis
Steven Howard Pollack 1979 281 p
Avail: Univ. Microfilms Order No. 8004255

The dynamic stability of open loop, constant voltage, permanent magnet step motor systems is examined. The mid frequency resonance region is highlighted. Analytical stability expressions are experimentally verified. A fourth order nonlinear model of a permanent magnet step motor is used. The model is linearized around a constant speed nominal trajectory. The resulting perturbed system is time varying. Techniques are presented for solving the perturbed system. Dissert. Abstr.

N80-18290 Clemson Univ., S.C.
A METHOD FOR THE TRANSIENT STABILITY ENHANCEMENT OF A POWER SYSTEM USING FEEDBACK CONTROL OF A SYNCHRONOUS GENERATOR Ph.D. Thesis
Haren Almaula 1979 97 p
Avail: Univ. Microfilms Order No. 8003338

A control strategy for augmenting the transient stability of a power system is developed using a direct phase model of a synchronous generator. The strategy uses prime-mover power and the excitation voltage of the synchronous generator as the controller variable. The control problem is formulated as a sequence of linear optimal control problems, where the control law is obtained from the backward solution of a Riccati type, matrix differential equation. Two different conditions of transient instability of a power system are considered. In each case the control strategy counters the instability resulting from a three phase-to-ground fault near the synchronous generator. The control strategy is applied only after the fault is removed. A gain of one cycle in the transient stability limit is observed in each case. Dissert. Abstr.

N80-18291 Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTRON AND HOLE PHOTOCURRENT EFFECTS ON IMPATT OSCILLATORS Ph.D. Thesis
Hanuman Prasad Vyas 1979 155 p
Avail: Univ. Microfilms Order No. 8004770

The effect of the magnitude and composition of leakage current on IMPATT oscillator performance is experimentally and theoretically evaluated. The principal effect of leakage current is to cause a reduction in the diode RF power output and an increase in the frequency of oscillations. The electron dominated leakage currents are more effective in reducing the RF power output and increasing the frequency of oscillations of an Impatt oscillator compared to leakage current dominated by holes. For experimental demonstration of leakage current effects flat profile, single drift region Impatt diodes were fabricated. A He-Ne laser was used as an optical source and the composition of leakage current with this source is changed by fabricating two types of devices. One with junction side down or flip chip to generate hole dominated leakage current and other with junction side up or top mounted to generate electron dominated leakage current. Dissert. Abstr.

N80-18292 New Jersey Inst. of Technology, Newark.
THEORY AND DESIGN OF CYCLOTRON-WAVE TRAVELING-WAVE AMPLIFIERS Ph.D. Thesis
Arthur Herman Gottfried 1979 277 p
Avail: Univ. Microfilms Order No. 8002664

The energy exchange mechanism and the axial beam velocity spread induced by RF interactions are examined. Analysis of the energy spread in a realistic model of the beam with nonzero size and nonzero space-charge density shows that higher maximum efficiencies at higher power is attainable (with collector depression) in cyclotron-wave amplifiers than in synchronous-wave amplifiers. A one-watt, and a ten-watt cyclotron-wave amplifier at 3 GHz, utilizing bifilar helix circuits, scaled from a 2 kW, 5 GHz design, were constructed. A computer was used to design a pitch taper for the circuit of the ten-watt tube to maintain synchronism between beam and circuit waves so as to enable the extraction of more energy from the beam. Test results indicate the possibility of attaining efficiencies of the order of 70% in a 2 kW, 5 GHz cyclotron-wave amplifier. Because of the relatively low interaction impedance available for transverse-wave interactions, it is estimated that gains of the order of 1 dB/inch are possible. Dissert. Abstr.

N80-18293 Missouri Univ. - Columbia.
PARALLEL DIGITAL SIMULATION OF POWER SYSTEMS Ph.D. Thesis
Alvin Lawrence Day 1979 223 p
Avail: Univ. Microfilms Order No. 8002351

A quadrature differential equation simulation technique suitable for parallel digital processors is developed. Parallel digital architectures are suggested which provide modular construction to allow expansion, modification, and easier maintenance of the simulator. The solution speed of the proposed fully programmable power system simulator is independent of the size of the simulated system. Detailed model equations are developed for several basic power system components using the quadrature differential equation technique. This technique of simulation is shown to be valid by comparisons with a conventional sequential digital program and a hybrid simulator. Faster than real time simulation with the TMS 9900 is shown to be possible by the substitution of a TMS 9900 steam turbine model into an analog simulation system scaled at twenty times faster than real time. Present microprocessors are feasible for simulation of only the slower solution rate models of a power system. The faster components may be simulated by either analog electronics or discrete digital hardware. Dissert. Abstr.

N80-18294 California Univ., Davis.
THE EFFECT OF NONUNIFORM CHANNEL DOPING ON HIGH FREQUENCY JFET AND MESFET DEVICES Ph.D. Thesis
Giovonnae Francesca Anderson 1979 155 p
Avail: Univ. Microfilms Order No. 8003495

A new load device for use in high speed switching circuits is presented. The device, a non-uniformly doped junction field effect transistor (NUDJFET), has a doping gradient along the length of the channel, that is, the doping at the source end of the channel is higher than the doping at the drain end of the channel. A model for this device was developed and used in computer simulations which compared gallium arsenide high speed switching circuits which used NUDJFETs as a load device with circuits employing conventional load devices. According to simulations, circuits using GaAs NUDJFETs should show a reduction in the speed power product ranging from 42% to 12% depending on the circuit configuration. Dissert. Abstr.

N80-18295 Alabama Univ., University.
DEVELOPMENT OF EQUIVALENTS FOR ELECTRIC POWER SYSTEM TRANSIENT STABILITY ANALYSIS Ph.D. Thesis
Nallicheri J. Balu 1979 208 p
Avail: Univ. Microfilms Order No. 8004528

The simplified representation of an external system was constructed in two stages: (1) a dynamic equivalent for reducing the number of generator terminal buses in the external system, and (2) a network equivalent for eliminating the unwanted nongenerator buses in the external system. The dynamic equivalents was developed based on the principle of coherency of generating units. A novel analytical technique, based on the study of trajectories of a power system in a state space was developed for the recognition of coherent machine groups during system disturbances. Two coherency-based techniques for the construction of dynamic equivalents of external systems are discussed, and computer programs were developed for the implementation of these techniques. The practical applicability and the accuracy of each of these two techniques is demonstrated. Dissert. Abstr.

N80-18296 Illinois Univ. at Urbana-Champaign.
STATE ESTIMATION OF LINEAR SYSTEMS DRIVEN SIMULTANEOUSLY BY WIENER AND POISSON PROCESSES Ph.D. Thesis
Samuel Horshing Poriza Au 1979 116 p
Avail: Univ. Microfilms Order No. 8004127

The case where the incident intensities of the Poisson processes are low and the system is observed in an additive white Gaussian noise is considered. The minimum mean-squared-error (MMSE) optimal filter is derived via the Doleans-Dade and Meyer differentiation rule for discontinuous semimartingales and its corresponding basic filtering theorem for white Gaussian observations noise. The nonclosedness property and performance of the filter are investigated. The results together with the performance of the linear optimal filtering schemes lead to the conclusion that causal filters and noncausal linear filters are inherently unsuitable for the state estimation for such class of systems. A noncausal nonlinear suboptimal scheme is developed for the estimation problem based on a combined estimation and detection strategy. A first order approximation scheme is included in the scheme to eliminate the error propagation effects that result from the sequential structure of the approach. Dissert. Abstr.

N80-18297 Toledo Univ., Ohio.
ANALYTICAL CORE LOSS CALCULATIONS FOR MAGNETIC

MATERIALS USED IN HIGH FREQUENCY HIGH POWER CONVERTER APPLICATIONS Ph.D. Thesis
James Edward Triner 1979 101 p
Avail: Univ. Microfilms Order No. 8002826

The basic magnetic properties under various operating conditions encountered in the state-of-the-art dc-ac/dc converters were examined. Using a novel core excitation circuit, the basic B-H and loss characteristics of various core materials were observed as a function of circuit configuration, frequency of operation, input voltage, and pulse-width modulation conditions. From this empirical data, a mathematical loss characteristics equation was developed to analytically predict the specific core loss of several magnetic materials under various waveform excitation conditions. Core excitations involving symmetric and asymmetric conditions for both sinusoidal and square wave waveforms were investigated analytically using three specific core loss calculation methods. The predicted and measured specific core losses were within 10 percent of each other for all conditions analyzed. Dissert. Abstr.

N80-18298# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
FIELD IMPACT EVALUATION PROCESS ON ELECTRONIC TABULAR DISPLAY SUBSYSTEM (ETABS) Final Report, Dec. 1978 - Jul. 1979
Oct. 1979 32 p
(AD-A078846; FAA-RD-79-100) Avail: NTIS HC A03/MF A01 CSCL 14/2

The process used in conducting a field impact evaluation of the electronic tabular display subsystem is described. Various group structural and process techniques are described. These include a diagonal slice approach to team formulation and several different methods of team building, process control, and conflict management. M.G.

N80-18299*# Texas Instruments, Inc., Dallas. Central Research Labs.
LOW POWER, COMPACT CHARGE COUPLED DEVICE SIGNAL PROCESSING SYSTEM Final Report, Apr. 1976 - Aug. 1978
P. W. Bosshart, D. D. Buss, W. L. Eversole, C. R. Hewes, and D. J. Mayer Feb. 1980 194 p refs
(Contract NAS1-14290)
(NASA-CR-3215; Rept-08-78-49) Avail: NTIS HC A09/MF A01 CSCL 09A

A variety of charged coupled devices (CCDs) for performing programmable correlation for preprocessing environmental sensor data preparatory to its transmission to the ground were developed. A total of two separate ICs were developed and a third was evaluated. The first IC was a CCD chirp z transform IC capable of performing a 32 point DFT at frequencies to 1 MHz. All on chip circuitry operated as designed with the exception of the limited dynamic range caused by a fixed pattern noise due to interactions between the digital and analog circuits. The second IC developed was a 64 stage CCD analog/analog correlator for performing time domain correlation. Multiplier errors were found to be less than 1 percent at designed signal levels and less than 0.3 percent at the measured smaller levels. A prototype IC for performing time domain correlation was also evaluated. R.C.T.

N80-18300*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID METAL SLIP RING Patent Application
Frank D. Berkopec, Robert R. Lovell, and David H. Culp, inventors (to NASA) Filed 21 Dec. 1979 11 p
(NASA-Case-LEW-12277-3; US-Patent-Appl-SN-106190) Avail: NTIS HC A02/MF A01 CSCL 09A

The liquid metal slip ring described comprises a rotor in the form of a range about an axis and a stator, the rotor being rotatable relative to the stator. The rotor has a channel in which the liquid metal is retained during operation by surface tension. The stator comprises a brush or probe which is partially immersed in the metal in the channel and is bidirectionally symmmetrical so that whichever direction the rotor turns the probe presents the same physical resistance and affords the same electrical conductivity as a connection between the probe and the rotor. Author

N80-18301*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY DESIGN OF LARGE REFLECTORS WITH FLAT FACETS
Pradeep K. Agrawal, Melvin S. Anderson, and Michael F. Card Jan. 1980 35 p refs
(NASA-TM-80164) Avail: NTIS HC A03/MF A01 CSCL 09C

A concept for approximating curved antenna surfaces using flat facets is discussed. A preliminary design technique for determining the size of the reflector surface facets necessary to meet antenna surface accuracy requirements is presented. A proposed large Microwave Radiometer Satellite is selected as an application, and the far field electromagnetic response of a faceted reflector surface is compared with that from a spherical reflector surface. Author

N80-18302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMIONIC CATHODE LIFE TEST STUDIES
Ralph Forman and Paul Elmer (Watkins-Johnson, Palo Alto, Calif.) 1980 11 p refs Proposed for presentation at the Tri-Services Cathode Workshop, New York, 15-17 Apr. 1980; sponsored by Dept. of the Air Force
(NASA-TM-81441; E-317) Avail: NTIS HC A02/MF A01 CSCL 09A

An update on the life testing of commerical, high current density impregnated tungsten cathodes is presented. The B-type cathodes, operated at a current density of 2 A/cm2 and a cathode temperature of 1100 C have now been run satisfactorily for more than four years. The M-cathode, at the same current density but at an operating temperature of only 1010 C, have been tested for more than three years. The M-cathodes show no degradation in current over their present operating life whereas the current from the B-cathodes degrade about 6 percent after four years of operation. R.E.S.

N80-18303# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
PROCESS VARIABLE DEPENDENCE AND INTERRELATIONSHIP BETWEEN AVALANCHE INJECTED AND RADIATION INDUCED CARRIER TRAPPING IN THERMAL OXIDES Progress Report, 1 Jul. - 30 Sep. 1979
Oct. 1979 15 p refs
(Contract N00014-79-C-0297)
(AD-A078362; PR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

Progress to data includes the completion of the automated avalanche carrier injection and trapping system, the preparation of samples to study hole and electron trapping in dry as well as wet oxides, and the measurements of the effects of various process parameters on the trapping characteristics of thermal silicon dioxide. GRA

N80-18304# Watkins-Johnson Co., Scotts Valley, Calif.
HIGH CONTRAST CRT Interim Report, 1 Oct. 1978 - 28 Feb. 1979
Glenn A. Holmquist Aug. 1979 31 p
(Contract DAAB07-77-C-2639; DA Proj. 1L1-62705-AH-94)
(AD-A076235; DELET-TR-77-2639-5; IR-5) Avail: NTIS HC A03/MF A01 CSCL 09/5

Sixteen faceplates were completed and characteristic optical data was recorded. The difficulties in production result from the properties of the faceplate glass limiting the maximum temperature of the La2O2S heat treatment. The optimum fabrication techniques, with this limitation, produced quality faceplates.GRA

N80-18305# Raytheon Co., Waltham, Mass. Research Div.
LOSSLESS BROADBAND MICROWAVE SWITCHES Interim Report, 1 Sep. 1978 - 31 Aug. 1979
James Vorhaus Sep. 1979 58 p
(Contract N00014-78-C-0623; RF54581001)
(AD-A076379; S-2609) Avail: NTIS HC A04/MF A01 CSCL 09/1

The GaAs dual-gate MESFET is a very powerful microwave device offering more gain and a wider range of functional capabilities than a conventional single-gate FET. It has also been demonstrated that the dual-gate FET can be switched from full off to full on in less than 50 psec. Combining the high gain and fast switching speed of this device with its inherently high isolation makes it an attractive candidate for microwave switching applications. This report describes the progress made during the first year of an effort to demonstrate the feasibility of using dual-gate FET's as high speed, broadband, lossless microwave switches. In this period, we have designed and fabricated two different dual-gate FET structures which functionally operate as multipole, multithrow switches with gain. We have achieved gains of 18 dB at 10 GHz from a more conventional dual-gate structure. This result is comparable to the best reported in the literature. We have also measured on-off ratios in excess of 30 dB and channel-to-channel isolation in excess of 25 dB in a multiport structure. Due to the many difficulties in handling multiport structures such as these, we have not yet been able to demonstrate signal switching. However, near the end of this report period we developed a new measurement technique which has the potential of eliminating many of the existing difficulties. GRA

N80-18306# Electronics Research Lab., Adelaide (Australia).
AN ANALYTIC ANALYSIS OF A KALMAN FILTER AND SMOOTHER
B. Billard Jul. 1979 26 p refs
(AD-A076140; ERL-0087-TR) Avail: NTIS HC A03/MF A01 CSCL 09/3

A Kalman filter and smoother which uses data from position measuring instrumentation to estimate changes in position, velocity, and acceleration is derived in detailed analytic form. The filtering and smoothing characteristics are shown to be completely determined by a single nondimensional parameter, which itself is a simple function of the input parameters to the filter. The concept of the bandwidth of the filter and the smoother is examined, and analytic expressions are derived for the bandwidth of the smoother, and of the filter with respect to position. The analysis highlights situations in which the smoother is clearly superior to the filter. GRA

N80-18307# Naval Postgraduate School, Monterey, Calif.
PERFORMANCE ANALYSIS OF A TYPE OF ELECTROHYDRODYNAMIC POWER GENERATOR
T. H. Gawain and Oscar Biblarz Apr. 1979 91 p
(AFOSR MIPR 78-0002)
(AD-A076115; NPS67-79-006) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report develops a detailed analysis of a type of electrohydrodynamic power generator which employs an ejector and a so-called 'fluid flywheel' as essential components. The medium is steam containing electrically charged water droplets. The analysis takes into account the experimentally established facts that the maximum strength of the electrical field that can be sustained at incipient breakdown at the most critical location is proportional to the fluid density at that location. It is shown that as a consequence of this fact, the electrical output can be maximized by designing the primary jet for an exit Mach number of 0.71. Estimates are made of the pump work required, of mixing losses in the ejector and of friction and secondary flow losses. The mathematical analysis is reduced to a fully nondimensional form and the key dimensionless parameters that govern performance are clearly identified. A preliminary estimate is made of the numerical values of these parameters and the overall performance of the system is estimated on this basis. GRA

N80-18308# Naval Ship Research and Development Center, Bethesda, Md.
NO-LOAD TESTING OF THE SHAPED FIELD SUPERCONDUCTIVE MOTOR Final Report
H. N. Robey, M. J. Cannell, and L. T. Dunnington Oct. 1979 60 p refs
(AD-A076125; DTNSRDC-79/076) Avail: NTIS HC A04/MF A01 CSCL 09/5

A laboratory-model superconductive d.c. motor, designed and constructed at the David W. Taylor Naval Ship Research and Development Center for peak power output in the 400 to 1000 hp range, has been undergoing no-load testing since January 1973. Results, reported herein, substantially validate the loss estimates (6.5 kW total power loss at 1800 rpm, 120 amp field current, open circuit) predicted in a prior analysis, and indicate that no major problems should be encountered in future planned load tests, with the possible exception of the collector electromagnetic stability, which cannot be evaluated satisfactorily at no-load conditions. Background information on machine development and discussions of the liquid metal and cryogenic helium handling procedures are also included. GRA

N80-18309# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
BONDED GRID DEVELOPMENT Final Technical Report, 1 Feb. 1978 - 31 Jan. 1979
Richard Dawson Griffiss AFB, N.Y. RADC Oct. 1979 83 p refs
(Contract F30602-78-C-0101; AF Proj. 4506)
(AD-A078631; RADC-TR-79-249) Avail: NTIS HC A05/MF A01 CSCL 09/1

This report details the results of efforts expended towards the development of a cathode and control grid assembly having the control grid solidly bonded to the cathode surface by means of a layer of insulating material. A device capable of emission and modulation was fabricated and tested. This effort demonstrated the feasibility of a control grid for microwave tubes fabricated with lithographic techniques directly on the cathode surface. When perfected this technique has two primary payoffs: (1) It will permit the use of high gain control grids at higher frequencies than possible with present shadow grid construction techniques, (2) It will also improve tube reliability, yield and construction cost. This technique will be applicable to microwave tubes used in tactical and ground based radars as well as ground based and satellite communications systems. GRA

N80-18310# Hughes Aircraft Co., Malibu, Calif.
OPTICAL-MICROWAVE INTERACTIONS IN SEMICONDUCTOR DEVICES Quarterly Report, 1 Jul. - 30 Sep. 1979
L. Figueroa, C. Slayman, and H. W. Yen Oct. 1979 29 p refs
(Contract N00173-78-C-0192)
(AD-A078538; QR-5) Avail: NTIS HC A03/MF A01 CSCL 09/1

GaAs FETs and Gunn diodes with built-in optical waveguides are being developed. The purpose is to allow optical signals to be coupled into the active region of the devices efficiently. These FETs will be useful for optical mixing, optical injection locking, and optical detection purposes. The Gunn diodes will be used for high-speed pulsed nodulation of injection lasers. GRA

N80-18311# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
PERMANENT MAGNET AND SUPERCONDUCTING GENERATORS IN AIRBORNE, HIGH POWER SYSTEMS Interim Report, 1 Feb. 1978 - 31 Mar. 1979
Hugh L. Southall and Frederick C. Brockhurst Aug. 1979 99 p refs
(AF Proj. 3145)
(AD-A078424; AFAPL-TR-79-2073) Avail: NTIS HC A05/MF A01 CSCL 10/2

This report presents results of a study performed to compare airborne, high power supplies at power levels of 10 and 20 MW utilizing permanent magnet and superconducting generators. Algorithms for the weight and volume of these electrical generators are presented and algorithms for the other power supply components are used to predict total system weights for seven point designs at the two power levels. GRA

N80-18312# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
PROCEEDINGS OF THE 1ST AFAPL GENERATOR AND MOTORS SEMINAR Interim Report, 1 Oct. - 1 Jul. 1979
Hugh L. Southall, J. L. McCabria, Sam Noodleman, M. S. Issaacson, W. F. Weldon et al Aug. 1979 210 p refs Conf. held at Wright-Patterson AFB, Ohio, Oct. 1977
(AF Proj. 3145)
(AD-A078341; AFAPL-TR-79-2090) Avail: NTIS HC A10/MF A01 CSCL 10/2

A seminar was held at Wright-Patterson AFB in October 1977 to provide for government, industry, and university presentations on the latest developments in generator and motor technology. In addition, the mathematical modeling of generator and motors was the subject of other presentations at the meeting.

This technical report organizes and publishes presentations made at the seminar. GRA

N80-18313# IIT Research Inst., Rome, N.Y.
MICROCIRCUIT DEVICE RELIABILITY DIGITAL FAILURE RATE DATA, SUMMER 1979
David B. Nicholls 1979 419 p refs
(Contract F30602-78-C-0281)
(AD-A077199; RAC-MDR-12) Avail: NTIS HC A18/MF A01 CSCL 09/5

This compendium of microcircuit device reliability is divided into two parts: Digital Failure Rate Summarized Data and Digital Device Data-Detailed Listings. The summaries pertain to warranty experience, and generic field, reliability demonstration, equipment checkout and life test data. The detailed listings consist of field, reliability demonstration, and equipment checkout experience as well as life test results arranged by operational type, manufacturer, and part number. MIL-HDBK-217B parameters have been incorporated into the entries to permit comparisons with predicted values. GRA

N80-18314# Widener Univ., Chester, Pa. Center of Engineering.
EFFICIENT FAULT ANALYSIS IN LINEAR ANALOG CIRCUITS Final Report, 28 May - 28 Jul. 1979
Alfred T. Johnson, Jr. Oct. 1979 81 p refs
(Grant AF-AFOSR-0106-79; AF Proj. 2305)
(AD-A078604; TR-79-03; AFOSR-79-1270TR) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report addresses the problem of high-resolution fault diagnosis in linear, analog electrical circuits in which a limited number of terminals are accessible for measurement. An efficient algorithm is described for computing network responses after a single parameter is changed. The computational complexity of this algorithm has been found to be very superior to that of a conventional algorithm. In addition, the problem of choosing a set of measurements for fault analysis has been studied. We have found necessary conditions for resolving the fault to the component level. The problems of measurement error and numerical conditioning have also been studied. GRA

N80-18315# Northrop Research and Technology Center, Palos Verdes Peninsula, Calif.
INVESTIGATION OF THE BASIC MECHANISMS OF RADIATION EFFECTS ON SEMICONDUCTOR DEVICES USED IN ELECTRO-OPTICAL SENSOR APPLICATIONS Final Report, Jan. 1978 - Jan. 1979
Joseph R. Srour, Siegfried Othmer, Susan C. Chen, and Robert A. Hartmann 31 Aug. 1979 147 p refs
(Contract DNA001-78-C-0028)
(AD-A076940; AD-E300617; NRTC-79-9R; DNA-4881F) Avail: NTIS HC A07/MF A01 CSCL 09/1

This report describes results of an investigation of radiation effects on semiconductor devices used in electro-optical sensor applications. Emphasis is placed on determining the basic mechanisms of the interaction of radiation with such devices with a view toward gaining understanding of benefit to developers of radiation-tolerant devices. A study of ionizing radiation effects on silicon MOS devices was performed at temperatures ranging from 4 to 77 degrees K. Charge buildup in the SiO2 layer was observed to be identical at 4 and 77 degrees K after a steady-state exposure to ionizing radiation, which indicates that electron trapping is not important at 4 degrees K. Results at both temperatures can be accounted for quite well in terms of hole trapping and hole transport. An investigation of the basic mechanisms of radiation effects on extrinsic silicon detector material was initiated. Carrier removal produced by neutron bombardment of such material was studied and it was found that the introduction rate of compensating defects depends strongly on the depth within the forbidden gap of the intentional dopant level. A detailed study of radiation effects on charge-coupled devices was performed, with emphasis placed on examining changes in dark current density produced by bombardment with neutrons and with ionizing radiation. The rate of increase in dark current density was found to be very similar for neutron-irradiated buried-channel CCDs obtained from two sources. Results of short-term annealing measurements on CCDs following pulsed neutron bombardment are also presented. A damage coefficient appropriate for describing the introduction of damage in silicon depletion regions was experimentally determined. GRA

N80-18316# North Carolina State Univ., Raleigh. Solid State Electronics Lab.
A THEORETICAL SEARCH FOR SUPER-VELOCITY SEMICONDUCTORS Annual Report, 1 Jan. - 31 Dec. 1979
M. A. Littlejohn Dec. 1979 79 p refs
(Contract N00014-76-C-0480; RR0210203)
(AD-A078719) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report presents the results of research on carrier transport in III-V semiconducting compounds and alloys and the performance of microwave devices fabricated from those compounds and alloys. GRA

N80-18317# Naval Academy, Annapolis, Md.
THE ELECTRICAL SWITCHING PROPERTIES OF AMORPHOUS BISMUTH TRIOXIDE THIN FILM DEVICES Final Report, 1978 - 1979
R. Stephen Weis 9 May 1979 58 p refs
(AD-A077662; USNA-TSPR-101) Avail: NTIS HC A04/MF A01 CSCL 20/12

Many gold-amorphous bismuth trioxide-gold layered devices, known as Bi-O-Trons were fabricated and their switching properties were investigated. The Bi-O-Trons were made by direct vacuum deposition. A unique microprocessor controlled measurement method was developed. This report also contains evidence that filaments can be formed by exclusively thermal effects. Also, evidence that suggests an electrothermal model of threshold switching is presented and discussed. Finally a conclusion about the possibility of the immediate application of Bi-O-Trons as memory cells is presented. GRA

N80-18318# Texas Technological Univ., Lubbock. Laser Lab.
STUDIES OF TRANSIENT DISCHARGES Annual Report, 15 Jun. 1978 - 14 Jun. 1979
P. F. William and M. A. Gundersen 1 Oct. 1979 29 p refs
(Contract F49620-79-C-0118; AF Proj. 2301)
(AD-A078894; AFOSR-79-1304TR; AR-2) Avail: NTIS HC A03/MF A01 CSCL 20/9

Progress during the time period June 15, 1978 through June 14, 1979 in our program to study the basic physical processes responsible for laser-induced breakdown of spark gaps is reported. Major accomplishments during the period include: (1) the measurement of temporarily and spatially resolved electron densities during and after the arc phase; (2) the study of the initial buildup of charge and current in these gaps; and (3) improvements in the data acquisition equipment used in the work. Evidence of a shock front seen in the electron density data was obtained. GRA

N80-18319# Naval Research Lab., Washington, D. C.
THE INSTABILITY BOUNDARY AND GROWTH RATE CONTOURS OF THE GYROTRON AMPLIFIER WITH SPREADS IN ENERGY AND MOMENTA
Joon Y. Choe and Saeyoung Ahn 14 Nov. 1979 13 p refs
(AD-A077450; NRL-MR-4106) Avail: NTIS HC A02/MF A01 CSCL 09/5

The combined effects of the spreads in energy and axial momentum of annular beam electrons in a gyrotron amplifier are spectrally investigated. A conveniently normalized dispersion relation is found for TE modes, and analyzed to obtain the instability boundary and growth rate contours. The spread effects prove to reduce the growth rate near the beam-waveguide synchronous mode, and enhance it for the mode out of synchronization. In particular the growth rate at the synchronous mode tends to peak when the electron distribution is thermally isotropic. GRA

N80-18320# California Univ., Berkeley. Electronics Research Lab.
ON-CHIP PERIPHERAL CIRCUITS FOR CCD SIGNAL PROCESSORS Final Report, 15 Jun. 1976 - 14 Jun. 1979
R. W. Brodersen and D. A. Hodges Jun. 1979 7 p refs
(Grant DAAG29-76-G-0244)
(AD-A076603; ARO-13962.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/5

Research has been carried out on real-time signal processing using techniques amenable to realization in large-scale integrated circuit technology. Specific system elements studied include precision frequency filters, multiplying digital-analog converters and correlators. GRA

N80-18321# Toulouse Univ. (France). Lab. de Genie Electrique.
THIN FILM DEPOSIT AND TREATMENT OF SURFACES BY ELECTRIC DISCHARGES [DEPOT DE COUCHES MINCES ET TRAITMENT DE SURFACES SOUS DECHARGE]
R. Lacoste 1978 19 p refs In FRENCH Presented at Assoc. pour le Develop. de l'Enseignement et de la Rech. de la Region Parisienne (ADERP) Seminar sur la Chimie des Plasmas, Paris, 20-24 Feb. 1978
(Publ-349) Avail: NTIS HC A02/MF A01

Industrial utilization of plasma is reviewed, focusing on semiconductor manufacturing, passive components manufacturing, and metallic surface treatments. The deposit of organic insulating thin films in semiconductor manufacturing is discussed. Metallic surface treatments including nitruration of iron and titanium alloys are reported. Author (ESA)

N80-18322# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Rechner- und Programmstrukturen.
METHODS FOR DIAGNOSIS OF FAULTS IN SWITCHING NETWORKS [METHODEN DER FEHLERDIAGNOSE IN SCHALTNETZEN]
Monika Rustemeier 1978 190 p refs In GERMAN
(GMD-Mitt-43) Avail: NTIS HC A09/MF A01

The existing processes for fault diagnosis in digital circuits are surveyed and discussed on a theoretical basis. Possible improvements are suggested for the most generally used. All the tests are, in principle usable, but in practice many have prohibitive computation requirements. Author (ESA)

N80-18323# National Technical Information Service, Springfield, Va.
FREQUENCY SYNTHESIZERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
William E. Reed Dec. 1979 204 p Supersedes NTIS/PS-78/1254; NTIS/PS-77/1102; NTIS/PS-76/0829; NTIS/PS-75/790 2 Vol.
(PB80-801905; NTIS/PS-78/1254; NTIS/PS-77/1102; NTIS/PS-76/0829; NTIS/PS-75/790) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Spread spectrum and single sideband communications, navigation, and frequency control are applications included in these Federally-sponsored research reports on frequency synthesizers. Methods and devices used include surface acoustic waves, digital control, number representation schemes, phase shift, cesium beam tubes, and phased locked systems. This updated bibliography contains 196 abstracts, 16 of which are new entries to the previous edition. GRA

N80-18324# National Technical Information Service, Springfield, Va.
FREQUENCY SYNTHESIZERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
William E. Reed Dec. 1979 222 p Supersedes NTIS/PS-78/1255; NTIS/PS-77/1103 2 Vol.
(PB80-801913; NTIS/PS-78/1255; NTIS/PS-77/1103) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Communications, radar, music synthesizers, frequency control, biomedical and test equipment, and microwave systems are applications of frequency synthesizers included in these research reports from worldwide literature. Methods and devices used include surface acoustic waves, phased locked systems, digital control, number representation schemes, and voltage controlled systems. This updated bibliography contains 214 abstracts, 31 of which are new entries to the previous edition. GRA

N80-18221 Boeing Aerospace Co., Seattle, Wash.
INCANDESCENT LAMP LIFE UNDER RANDOM VIBRATION
Clark J. Beck, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 71-81 refs
(For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-18325 State Univ. of New York at Stony Brook.
A FUNCTIONAL APPROACH TO THE STATISTICAL MECHANICS OF FLUID PARTICLES IN TURBULENCE Ph.D. Thesis
Taylan Alankus 1979 95 p
Avail: Univ. Microfilms Order No. 8004403

A turbulence formalism based on the generating functional for the probability density functions of a turbulent Eulerian velocity field is presented. For incompressible fluids it is shown that the generating functional coincides with the characteristic functional of a random scalar field which can be considered as the microscopic density for fluid particles. The dynamical equations for the microscopic density and the generating functional are derived, and it is demonstrated at the functional level that the whole formalism is mathematically indistinguishable from the statistical dynamics of a closed system of (many) identical particles interacting with velocity dependent and dissipative forces. The dynamical equation for the generating functional is formally solved by using functional integration technqiues, and the integral representations of the probability density functions are given. Some fluid dynamical model equations for which the integral representations can be evaluated explicitly are considered. Dissert. Abstr.

N80-18326 Kansas Univ., Lawrence.
A NUMERICAL INVESTIGATION OF THE TWO STREAM INSTABILITY AND RESONANT HEATING OF AN INHOMOGENEOUS, AXISYMMETRIC, PLASMA COLUMN Ph.D. Thesis
Mohammad Taghi Ahmadian 1979 185 p
Avail: Univ. Microfilms Order No. 8002745

An inhomogeneous, cylindrically axisymmetric electron plasma confined electrostatically by immobile ions and with an external boundary surface is considered. A two stream instability excited by axial counter-streaming is followed through limiting amplitude for one or two unstable wavenumbers. The results show that the limiting amplitude is largest for the wavenumber with largest growth rate, consistent with the one-dimensional result. In the case of multiple unstable waves, the first wave to reach limiting amplitude modifies the distribution function and 'turns off' the instability before the other waves reach the limiting amplitudes they would attain as isolated waves. An electric field is applied on the boundary of the plasma along the axis of the cylinder. Power amplification through a thermonuclear fusion reaction is achieved by using the wave to speed up particles on the tail of the distribution function. The maximum power amplication occurs at a frequency omega = 1.3 omega(p). Dissert. Abstr.

N80-18327 Illinois Inst. of Tech., Chicago.
HEAT, MASS AND MOMENTUM TRANSFER THROUGH SPRAYS Ph.D. Thesis
Mohan L. Jain 1979 293 p
Avail: Univ. Microfilms Order No. 8003649

An experimental facility consisting of a subsonic wind tunnel, a spray generation system and instrumentation was designed and constructed. A numerical-photographic procedure was developed for analyzing drop trajectories to imply drop drag coefficients. Experiments were conducted over a Reynolds number range of 1000-3500, and it was found that the drops in the sprays of the present type experience up to 18% higher drag than single drops. Thermal experiments to determine average heat and mass transfer through sprays were conducted over a Reynolds number range of 1000-2500 for three different spray configurations involving two volume fractions. It is shown that the widely used Ranz-Marshall correlations for single drops give too high a prediction for heat and mass transfer in the present system. Only 36-67% of the calculated transport actually occurred over the Reynolds number range studied. Dissert. Abstr.

N80-18328 Florida Univ., Gainesville.

ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE EFFECT OF DYES ON SOLAR DISTILLATION Ph.D. Thesis

Anil Kumar Rajvanshi 1979 203 p

Avail: Univ. Microfilms Order No. 8002890

A model was developed which treated the transient heat transfer inside the dye-water system as one dimensional. Coupled with this was the energy exchange from the surface of water to the glass cover by convection, radiation and evaporation of water. A finite difference technique was used in solving the nonlinear partial differential equations. The results from the model were compared with those from an experimental investigation using two identical solar stills (4 ft. x 4 ft. x 1 ft.). The control still contained water only while the other had dye-water solution. The dyes used were Black Napthylamine, Red Carmoisine and Dark Green, with various concentrations. An increase in distillate output resulted with increasing dye concentration, but became independent of concentration after 500 ppm. The change of increase of output with concentration of the dye was different for different dyes (among those tested) with Black having the maximum rate and Red having the lowest. For the spring conditions at Gainesville, Florida, the optimum concentrations for Black, Green and Red dyes were 218 ppm, 377 ppm and 408 ppm, respectively. Dissert. Abstr.

N80-18329 Old Dominion Univ., Norfolk, Va.

EFFECT OF PRECURSOR HEATING ON RADIATING AND CHEMICALLY REACTING VISCOUS FLOW AROUND A JOVIAN ENTRY BODY Ph.D. Thesis

Kuo-Yen Szema 1979 185 p

Avail: Univ. Microfilms Order No. 7927104

The influence of changes in the precursor region flow properties (resulting from absorption of the radiation from the shock layer) on the entire shock layer flow phenomena around a Jovian entry body was investigated. Realistic thermo-physical and radiation models are used and results are obtained by employing the implicit finite difference technique in the shock layer and an iterative procedure for the entire shock layer-precursor zone. Results obtained for a 45 deg hyperboloid blunt body entering the Jupiter's atmosphere at zero angle of attack indicate that pre-heating of the gas significantly increases the static pressure and temperature ahead of the shock for entry velocities exceeding 36 km/sec. The nonequilibrium radiative heating rate to the body is found to be significantly higher than the corresponding equilibrium heating. The precursor heating, in general, increases the radiative and convective heating to the body, and this increase is slightly higher for the nonequilibrium conditions. Dissert. Abstr.

N80-18330 Oklahoma State Univ., Stillwater.

LAMINAR FREE CONVECTIVE HEAT TRANSFER IN THE SUPERCRITICAL REGION WITH VARIABLE FLUID PROPERTIES Ph.D. Thesis

Afshin Jahanshahi Ghajar 1979 207 p

Avail: Univ. Microfilms Order No. 8003574

A technique was developed which allowed predictions of heat transfer to fluids in the supercritical region. This technique proved to be more general, less complicated, easier to use, and more accurate in comparison to the existing prediction schemes. The heat transfer predictions are in good agreement with the existing variable property experimental data. Analytical methods for predicting thermodynamic and transport properties in the supercritical region were developed from the available experimental data. A shorthand method (reference temperature) was developed by which heat transfer to fluids in the supercritical region under variable property conditions can be evaluated. The heat transfer results obtained with the reference temperature scheme showed good agreement with the existing variable property theoretical and experimental results. Dissert. Abstr.

N80-18331 California Univ., Davis.

HEAT TRANSFER TO AIR FROM A YAWED ISOTHERMAL CYLINDER Ph.D. Thesis

John Stanford Kraabel 1979 222 p

Avail: Univ. Microfilms Order No. 8003518

Local and mean heat transfer coefficients were determined experimentally at two subscritical Reynolds numbers for forced convective heat transfer from an isothermal circular cylinder to air. The stagnation point and laminar boundary layer heat transfer was found to be dependent only on the Reynolds number based on the velocity component normal to the cylinder. The local heat transfer from the rear of the cylinder, for moderate yaw (up to 40%), was also independent of the spanwise component of flow. At higher angles (50 deg, 60 deg), the heat transfer from the rear of the cylinder is dependent on both yaw and Reynolds number. The region of minimum heat transfer, which occurs in the vicinity of flow separation, was found to be dependent on the yaw. A numerical solution of the stagnation point and laminar boundary layer equations is presented. The numerical heat transfer results compare favorably with the experimental data. Dissert. Abstr.

N80-18332 Lehigh Univ., Bethlehem, Pa.

AN EXPERIMENTAL AND THEORETICAL STUDY OF THE CONFINED VORTEX WITH HIGH FLOW RATE Ph.D. Thesis

Walter Jeffrey Shakesphere 1979 156 p

Avail: Univ. Microfilms Order No. 8003070

The behavior of the flow field in the vortex chamber when the radial and tangential velocities are of equal order of magnitude at the cylindrical distributor and the Reynolds number based on chamber radius and radial velocity is of order 10,000 was investigated. A model was developed by piecing together the analyses for three regions, including the main part of the flow field, the portion near the end walls and the viscous core close to the axis of symmetry. It is shown that although the end wall secondary flow patterns persist, the end wall boundary layers may be uncoupled from the flow in the main region. An explanation for the variation in the size of the viscous core region with changes in operating parameters is presented and compared with a previous theory now used extensively in vortex modelling. A parametric analysis of the radial velocity profiles with changes in geometry was also done. Dissert. Abstr.

N80-18333 Princeton Univ., N. J.

MACROSCOPIC DESCRIPTION OF MULTI-PHASE SYSTEMS: A THERMODYNAMIC THEORY OF FLOW IN POROUS MEDIA Ph.D. Thesis

Majid Hassanizadeh 1980 289 p

Avail: Univ. Microfilms Order No. 8005288

A systematic averaging technique was developed and used to derive multi-phase equations of mass, momentum, angular momentum, energy and entropy from the balance laws for a single continuum. The technique was systematized by requiring a single set of criteria to govern the averaging of all quantities and all equations. Next, a constitutive theory for solid-fluid systems was developed. Finally, the general form of constitutive assumptions for porous media was reduced using the Coleman and Noll method of exploitation of entropy inequality. The constitutive equations were then linearized and a set of field equations were obtained which provided nine equations to be solved for fluid density, porosity, fluid velocity vector, solid displacement vector and the medium temperature. Certain fluid flow cases were reviewed and appropriate equations of varying degrees of approximation were obtained. Dissert. Abstr.

N80-18334 Cornell Univ., Ithaca, N. Y.

TURBULENCE MODELING IN HOMOGENEOUS FLOWS: DETERMINATION OF THE RAPID TERMS Ph.D. Thesis

Yasuo Bikane 1979 114 p

Avail: Univ. Microfilms Order No. 8003970

A method to determine the rapid terms in homogeneous turbulence was studied. The invariant functions in the dissipation equation were determined by data matching. The unknown invariant functions in the rapid terms were determined theoretically by using optimum variables and the independency hypothesis. In order to predict the existing data, one of the invariant functions was modified. The dissipation equation was also modelled by the invariant technique. Because the form of the invariant functions in the equation is unknown, the form was assumed with two unknown constants which were optimized by data matching. The set of the modeling equations was tested for four experiments. The results agree reasonably with the experimental data. Dissert. Abstr.

N80-18335 Texas A&M Univ., College Station.
THE EFFECTS OF SPRAY ENTRAINMENT ON THE MEAN WIND PROFILE AND THE OVERALL LOAD ON MARINE STRUCTURES Ph.D. Thesis
John Michael Macha 1979 101 p
Avail: Univ. Microfilms Order No. 8003163

A model for the mean wind profile was developed. The log law for turbulent flow past a solid rough boundary was modified and applied to the relative wind speed over a wavy water surface. The waves were treated as individual roughness elements and the transfer of wind momentum to entrained spray drops was accounted for by an additional additive term. Experimental measurements in a high speed wind/wave channel showed that an equivalent 10-meter wind speed of 57 m/sec, the drag on entrained spray drops accounted for over 30 percent of the total momentum transfer from the wind. The spray content of the air at high wind speeds, was investigated from the standpoint of additional loading on marine structures due to spray impact. A maximum limiting spray concentration of .001 grams/cucm was determined based on the available turbulent mechanical energy in the wind shear layer. In addition, extensive measurements of spray concentration and impact force were conducted in the wind/wave channel. Dissert. Abstr.

N80-18336 Princeton Univ., N. J.
DEFORMATION AND HYDRODYNAMIC INTERACTION OF TWO PARTICLES IN A SUSPENSION Ph.D. Thesis
Mark Menachem Friedman 1979 167 p
Avail: Univ. Microfilms Order No. 8003782

The interactions between two particles immersed in a Newtonian fluid are studied under conditions such that inertial effects are negligible and no external forces or couples act on the particles. The flow field used is that produced by the Maxwell orthogonal rheometer. This flow field displays a nonzero vorticity and rate of deformation. Theories pertaining to the deformation of a single drop and the interaction of two solid spheres are combined and applied to the orthogonal rheometer flow field. Particle trajectories are obtained for two solid spheres, two fluid spheres, and two deformable drops in the linear, uniform shear flow field. Agreement between the theory and experiments performed in an orthogonal rheometer is obtained for only a few special cases. The lack of agreement is attributed to secondary flows induced by wall effects. These effects were shown to be produced by the bottom plate container wall and were related to the geometrical asymmetry of the orthogonal rheometer. Suggestions are offered as to how such problems may be overcome in the future. Dissert. Abstr.

N80-18337*# Little (Arthur D.), Inc., Cambridge, Mass.
EXPERIMENTAL STUDY OF THE STABILITY AND FLOW CHARACTERISTICS OF FLOATING LIQUID COLUMNS CONFINED BETWEEN ROTATING DISKS Final Report
A. A. Fowle, L. Soto, P. F. Strong, and C. A. Wang Feb. 1980 129 p
(Contract NASw-3186)
(NASA-CR-162800) Avail: NTIS HC A06/MF A01 CSCL 20D

A low Bond number simulation technique was used to establish the stability limits of cylindrical and conical floating liquid columns under conditions of isorotation, equal counter rotation, rotation of one end only, and parallel axis offset. The conditions for resonance in cylindrical liquid columns perturbed by axial, sinusoidal vibration of one end face are also reported. All tests were carried out under isothermal conditions with water and silicone fluids of various viscosities. A technique for the quantitative measurement of stream velocity within a floating, isothermal, liquid column confined between rotatable disks was developed. In the measurement, small, light scattering particles were used as streamline markers in common arrangement, but the capability of the measurement was extended by use of stereopair photography system to provide quantitative data. Results of velocity measurements made under a few selected conditions, which established the precision and accuracy of the technique, are given. The general qualitative features of the isothermal flow patterns under various conditions of end face rotation resulting from both still photography and motion pictures are presented. R.C.T.

N80-18338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC THERMAL SWITCH Patent Application
Lawrence D. Wing and Joseph W. Cunningham, inventors (to NASA) Filed 30 May 1979 23 p
(NASA-Case-GSC-12415-1; US-Patent-Appl-SN-043943) Avail: NTIS HC A02/MF A01 CSCL 20D

An automatic heat flow control switch consisting of a thermal transfer plate pivotally mounted between two thermally conductive plates is described. A phase change power unit which includes a plunger is in contact with one of the conductive plates. When the unit is actuated by an increase in heat transmission, the plunger extends and pivots the transfer plate to vary the thermal conduction. An element connected to the transfer plate biases the transfer plate in a predetermined position with respect to the conductive plates. The biasinq element, transfer plate, and piston can be arranged to provide either a closed or open thermally conductive path. The switch is to be used to control the temperature of electronic instruments in the Space Shuttle equipment bays. NASA

N80-18339*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF NUMERICAL SOLUTIONS TO NONLINEAR PROBLEMS OF FLUID MECHANICS OBTAINED BY THE METHOD OF LEAST SQUARES AND THE FINITE ELEMENT METHOD TO UNSTEADY NAVIER-STOKES EQUATIONS
B. Mantel, J. Periaux, and P. Perrier Dec. 1979 32 p refs
Transl. into ENGLISH of conf. paper "Une Application de la Solution Numerique de Problemes Non-lineaires en Mecanique des Fluides, par les Methodes de Moindres-Carres abstraits et d'elements Finis, aux Equations de Navier-Stokes Instantionnaires" Assoc. Aeron. et Astron. autique (France), 1978 33 p Presented at the Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978. Original language document announced as A79-32281 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75727) Avail: NTIS HC A03/MF A01 CSCL 20D

A method of calculating viscous fluid flows having an average Reynolds number is presented. J.M.S.

N80-18340*# Old Dominion Univ. Research Foundation, Norfolk, Va.
EXPERIMENTAL STUDY OF FLOW DUE TO AN ISOLATED SUCTION HOLE AND A PARTIALLY PLUGGED SUCTION SLOT Final Report, 1 Feb. 1978 - 31 Jan. 1980
G. L. Goglia and Stephen P. Wilkinson Feb. 1980 36 p refs
(Grant NsG-1491)
(NASA-CR-162808) Avail: NTIS HC A03/MF A01 CSCL 20D

Details for construction of a model of a partially plugged, laminar flow control, suction slot and an isolated hole are presented. The experimental wind tunnel facility and instrumentation is described. Preliminary boundary layer velocity profiles (without suction model) are presented and shown to be in good agreement with the Blasius laminar profile. Recommendations for the completion of the study are made. An experimental program for study of transition on a rotating disk is described along with preliminary disturbance amplification rate data. M.G.

N80-18341*# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
RESONANT DOPPLER VELOCIMETER Ph.D. Thesis. Final Report, 1 Jul. 1974 - 31 Oct. 1979
Micha Zimmermann Mar. 1980 247 p refs
(Grant NsG-1070)
(NASA-CR-162815; MAE-T-1465) Avail: NTIS HC A11/MF A01 CSCL 20D

A technique is presented for visualizing and quantitatively measuring velocity, temperature, and pressure by shining a single frequency laser beam into a gaseous flow which is seeded with an atomic species. The laser is tuned through the absorption frequencies of the seeded species and the absorption profile is detected by observing fluorescence as the atoms relax back to the ground state. The flow velocity is determined by observing the Doppler shift in the absorption frequency. Spectroscopic absorption line broadening mechanisms furnish information regarding the static temperature and pressure of the moving gas. Results of experiments conducted in the free stream and in the bow shock of a conical model mounted in a hypersonic wind tunnel indicate that the experimental uncertainties in the measurement of average values for the velocity, temperature and pressure of the flow are 0.1, 5 and 10 percent respectively. K.L.

N80-18342# Defence Research Establishment Suffield, Ralston (Alberta).

A SEMI-EMPIRICAL EQUATION FOR THE VISCOSITY OF AIR

James J. Gottlieb and David V. Ritzel Jul. 1979 23 p refs
(AD-A072053; DRES-TN-454) Avail: NTIS HC A02/MF A01 CSCL 20/4

Sutherland's theoretical expression for the absolute or dynamic viscosity of a gas has been modified to represent experimental viscosity data for air. The resulting semi-empirical equation accurately describes measured viscosities of air for temperatures ranging from the boiling point at 78 K to molecular dissociating conditions at 2500 K. Discrepancies between measured values and semi-empirical results rarely exceed 2%. Other more limited expressions for the viscosity of air are also compared to measured viscosity data and discussed. GRA

N80-18343# McDonnell-Douglas Research Labs., St. Louis, Mo.

VISCOUS FLOWFIELDS INDUCED BY TWO- AND THREE-DIMENSIONAL LIFT JETS IN GROUND EFFECT Final Technical Report, 1 Feb. 1976 - 28 Feb. 1979

W. W. Bower, R. K. Agarwal, G. R. Peters, and D. R. Kotansky 1 Mar. 1979 38 p refs
(Contract N00014-76-C-0494; NR Proj. 215-246; RR0141184)
(AD-A078782; ONR-CR-215-246-3F) Avail: NTIS HC A03/MF A01 CSCL 20/4

An important consideration for VTOL aircraft design is the aerodynamic interaction between airframe undersurfaces and the ground. In an effort to predict this phenomenon, a second-order-accurate, finite-difference scheme for solution of the two- and three-dimensional conservation equations of fluid mechanics, in combination with a turbulence model, is described. The solution technique is applied to a planar lift jet in ground effect for both incompressible and compressible flow and to two interacting incompressible jets with fountain formation. Fluid properties that characterize the jet impingement flowfields are given for a range of Reynolds numbers, and comparisons with measured data are presented. GRA

N80-18344# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

STUDY OF THREE-DIMENSIONAL INTERNAL FLOW PROBLEMS RELATED TO TURBOMACHINERY FLOWS Annual Report, 1 Jan. - 31 Dec. 1978

Kirti N. Ghia and Urmila Ghia Feb. 1979 68 p refs
(Contract F49620-78-C-0041; AF Proj. 2307)
(AD-A078376; AFL-79-2-46; AFOSR-79-1264TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

The primary objective of this two-year research project is to develop a finite-difference numerical technique for the solution of the parabolized Navier-Stokes equations using a system of surface-oriented coordinates suitable for ducts of arbitrary geometry. An additional objective to be fulfilled by this research consists of developing an analysis for laminar duct flow with stream wise separation using mathematical models simpler than the full Navier-Stokes equations. In order to achieve the above objectives, the following three problems have been studied during the first year of the two-year contract period: (1) Laminar Flow through Joukowski ducts, (2) Laminar flow through curved polar ducts, and (3) Analysis of laminar streamwise flow separation via a semi-elliptic mathematical model. In each phase of the research attention is given to the accuracy of the numerical solutions as well as the efficiency with which they can be determined. For this purpose, the following two additonal areas have been studied: (4) Higher accuracy of numerical solutions, and (5) Efficient numerical algorithms. Suitable model problems have been selected wherever required, in this research, with the overall goal of contributing to further the understanding of internal flows in turbomachinery. Each of the above research areas is described in this report. GRA

N80-18345# Brussels Univ. (Belgium). Inst. de Mecanique Appliquee.

THEORETICAL STUDY OF THERMAL LOSSES: THE USE OF HYBRID AND COMBINED DRY COOLANTS [ETUDE DE BASE DES REJETS THERMIQUES: UTILISATION DE REFRIGERANTS SECS, HYBRIDES ET COMBINES]

Andre L. Jaumotte, Pierre Decock, Bernard Leduc, and Philippe Nagel 1978 67 p refs In FRENCH Sponsored by Groupement Ecologique Belge (GEBEG)
(NT-44-1978) Avail: NTIS HC A04/MF A01

After a brief review of techniques used in the disposal of waste heat from electrical power plants, dry coolant systems are cited as a promising solution. Emphasis is placed on the size reduction of cooling towers, on further limiting heat exchanger surfaces by using special cooling fin profiles, and on the introduction of an intermediary cold cycle between the condenser and the coolant (ammonia cycle). Results show that a combined wet tower/dry tower system has short term advantages, especially from a cost effectiveness point of view (reduced ecological impact). Three regions in Belgium are taken as examples of areas that might benefit from this scheme. As a long term solution the use of a condensable fluid (ammonia) with a cold cycle for recuperating thermal energy is suggested. Author (ESA)

N80-18346# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany). Lehrstuhl fuer Angelwandte Mechanik und Stroemungsphysik.

MORPHOLOGICAL AND PHENOMENOLOGICAL STUDY OF THE TRANSFORMATION OF A RING VORTEX COLLIDING WITH AN OBJECT [MORPHOLOGISCH-PHAENOMENOLOGISCHE UNTERSUCHUNG DER UMBILDUNG VON RINGWIRBELN, DIE KOERPER ANSTROEMEN]

Peter E. M. Schneider Apr. 1978 209 p refs In GERMAN
(MPIS-14/1978; ISSN-0436-1199) Avail: NTIS HC A10/MF A01; Max-Planck Inst. fuer Stroemungsforsch., Goettingen, West Germany DM 62.70

Photographic methods were used to study the formation of turbulence caused when one fluid was introduced into another. The experimental conditions and apparatus are described including the geometry of the vortex generator. The influence of the form of the target upon the vortex is shown in the case of spheres, cylinders, screens, and flat plates. Analogies are made between these phenomena and optical reflection. Author (ESA)

N80-18347# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

FORMATIONS AND TRANSFORMATIONS OF A LIQUID STREAM FLOWING IN AIR FROM POLYGONALLY SHAPED NOZZLES [BILDUNG UND UMBILDUNG VON FLUESSIGKEITSSTRAHLEN, DIE DURCH POLYGONFOERMIGE OEFFNUNGEN IN LUFT AUSSTROEMEN]

Georg E. H. Schrader Dec. 1978 175 p refs In GERMAN
(MPIS-28/1978) Avail: NTIS HC A08/MF A01; Max-Planck Inst. fuer Storemungsforsch., Goettingen, West Germany DM 53.90

The formation, persistance, and onset of turbulence and the disappearance of regular stream shapes was studied empirically with photographic techniques. Descriptions of the experimental apparatus are given. Orifice shapes included many geometric forms, symmetric and nonsymmetric as well as slits. Author (ESA)

N80-18348# Association Aeronautique et Astronautique de France, Paris.

THE INFLUENCE OF A HIGH PRESSURE GRADIENT ON UNSTEADY VELOCITY PERTURBATIONS IN THE CASE OF A TURBULENT SUPERSONIC FLOW [INFLUENCE D'UN

FORT GRADIENT DE PRESSION SUR DES PERTURBATIONS INSTATIONNAIRES DE VITESSE CAS D'UN ECOULEMENT TURBULENT SUPERSONIQUE]
J. J. Dussauge and J. F. Debieve Jul. 1979 28 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-10; ISBN-2-7170-0537-4) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 17 (France and EEC) FF 21 (others)

The amplification or reduction of unsteady velocity perturbations under the influence of strong flow acceleration or deceleration is studied. Supersonic flows with large velocity and pressure gradients are examined and the conditions in which the velocity fluctuations depend on the action of the average gradients of pressure and velocity, rather than turbulence, are described. Experimental results obtained on a cylinder positioned parallel to the flow are analyzed statistically and interpreted as a 'return to laminar' process. It is shown that this 'return to laminar' implies negative values in the turbulence production terms for kinetic energy. A simple geometrical representation of the Reynolds stress production is given. It is also shown that in the experimental case the influence of viscous energy dissipation cannot be neglected. Author (ESA)

N80-18349# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
A TURBULENT LAYERS DESCRIPTION OF UNSTEADY TWO DIMENSIONAL FLOW [MODELISATION D'ECOULEMENTS BIDIMENSIONNELS INSTATIONNAIRES PAR DES NAPPES TOURBILLIONNAIRES]
C. Berger Paris Assoc. Aeron. et Astronautique de France 1979 32 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(AAAF-NT-79-18; ISBN-2-7170-0545-5) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

The modeling of free layers is examined. It is shown that for computations based on point vortices, models do not adequately describe continuous media flow. Taking into account the continuity of the layer by means of fluid segments allows the elimination of those irregularities and makes it possible to calculate its deformation to a very advanced degree. Examples of Kelvin-Helmholtz instability are presented and compared with the linear theory. This model is then applied to an alternative vortices regime in a flow around a cylinder. The evolution of the pressure distribution on the cylinder is represented adequately by this model. Author (ESA)

N80-18350# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ON THE EVOLUTION, PERSISTANCE, INSTABILITY, REGENERATION AND DISAPPERANCE OF VORTEX RINGS [WERDEN, BESTEHEN, INSTABILITAET, REGENERATION, VERGEHEN EINES RINGWIRBELS]
Peter E. M. Schneider Aug. 1978 178 p refs In GERMAN
(MPIS-17/1978; ISSN-0436-1199) Avail: NTIS HC A09/MF A01

A detailed description was made of the successive phases occuring during the evolution of vortex rings in a fluid. Theoretical conditions of stability and instability are studied in connection with variations in energy. An analogy is made with acoustical and luminous phenomena. Author (ESA)

N80-18351# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
SPONTANEOUS LIQUEFACTION IN RETROGRADE FLUIDS UNDER CONDENSATION SHOCK WAVES [SPONTANE KONDENSATION RETROGRADER GASE DURCH VERDICHTUNGSSTOESSE]
Hans-Dieter Speckmann Oct. 1978 91 p refs In GERMAN
(MPIS-21/1978; ISSN-0436-1199) Avail: NTIS HC A05/MF A01

A theoretical review of the conditions for partial and total liquefaction of a saturated vapor under the effect of an isentropic compression is presented, and a shock tube was examined with several gases to develop observational techniques. These involved the use of the phenomenon of extinction of laser light in place of photographic techniques. Author (ESA)

N80-18352# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
ENVIRONMENTAL STUDY OF THE INTERACTION OF TWO VORTEX RINGS HAVING THE SAME AXIS OF SYMMETRY [EXPERIMENTELLE UNTERSUCHUNG DER WECHSELWIRKUNG ZWEIER RINGWIRBEL MIT GEMEINSAMER SYMMETRIEACHSE]
Hans-Heinrich Claus Nov. 1979 88 p refs In GERMAN
(MPIS-26/1978) Avail: NTIS HC A05/MF A01

Observations were made of two vortex rings produced by the same orifice, in the case where one overtakes the other. The relationship between the initial speeds (in a fluid) determines whether the rings coalesce or whether one passes the other. The resulting energy exchange is studied, and comparisons are made with theoretical calculations. Author (ESA)

N80-18353# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
COMPARISON OF SEVERAL FINITE DIFFERENCE SCHEMES FOR TIME MARCHING METHODS AS APPLIED TO ONE DIMENSIONAL NOZZLE FLOW
W. vanHove and A. Arts Jun. 1979 51 p refs
(VKI-TN-132) Avail: NTIS HC A04/MF A01

One dimensional, inviscid, transonic flow with shock through a convergent divergent nozzle was used as a test case to compare several explicit finite difference schemes for time marching methods. The comparison was carried out both theoretically and numerically, and accounted for stability conditions and convergence speed. Additional means to improve the convergence of time marching methods are also discussed. Author (ESA)

N80-18354# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
PERTURBATION SOLUTIONS FOR BLAST WAVES IN A LOW DENSITY GAS
S. Srinivasan Aug. 1978 46 p refs
(VTH-LR-263) Avail: NTIS HC A03/MF A01

A solution for the propagation of blast waves in a low density gas, in which a virial power expansion in terms of the parameter lambda representing the product of the internal volume of the molecules which is assumed to be constant and the initial gas density is used in the equation of state, is presented. Analytical expressions are obtained by means of a perturbation technique showing the dependence of pressure, density, and gas velocity on the distance from the origin of the explosion and the distance of the shock front. The influence of the parameter lambda on the flow field and temperature distributions is studied at different stages of the explosion process. Shock velocity variations with the shock propagation distance and shock trajectories are also determined. A comparison is made with ideal gas solutions. It is found in a significant temperature drop near the origin. Author (ESA)

N80-18355# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
NON-UNIFORM PROPAGATION OF CYLINDRICAL SHOCKS AND DETONATIONS
S. Srinivasan Aug. 1978 39 p refs
(VTH-LR-264) Avail: NTIS HC A03/MF A01

Nonuniform propagation of diverging cylindrical shocks and detonations are considered. The nonsimilar effects due to counter pressure are accounted for in the case of shocks. For overdriven detonations, the nonsimilar effect due to heat release at the wave front is taken into account. Detailed flow patterns and characteristic properties are presented for these two situations. Author (ESA)

N80-18356# Research Inst. of National Defence, Stockholm (Sweden).
MODEL FOR THE FRONT PROPAGATION IN A DETONATING GAS
Sven Wahlborn and Hjoerdis Celander Sep. 1978 30 p refs
(FOA-C-20323-D6(D8)) Avail: NTIS HC A03/MF A01

The general laws for the propagation of an explosion wave in a perfect gas are presented and reformulated in a pair of characteristic equations. The solutions of these equations are discussed for nonsteady detonation processes where the front speed (U) is allowed to vary in a regular fashion with front location (R). In a simplified model, governed essentially by the Hugoniot conditions and overall energy conservation, an explicit relation between U and R is derived for a strong detonation (spherical case). This model is applied to unconfined divergent detonation and to laser driven detonation. Conclusions are drawn about the qualitative validity of the model and the initiation criteria for the processes considered. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation,* and *15 Spacecraft Instrumentation.*

N80-18357* National Aeronautics and Space Administration. Pasadena Office, Calif.
VISCOSITY MEASURING INSTRUMENT Patent
Samuel P. Feinstein, inventor (to NASA) (JPL) Issued 29 Jan. 1980 6 p Filed 23 Jun. 1978 Supersedes N78-27385 (16 - 18, p 2390) Sponsored by NASA
(NASA-Case-NPO-14501-1; US-Patent-4,185,493; US-Patent-Appl-SN-918535; US-Patent-Class-73-56; US-Patent-Class-73-343R; US-Patent-Class-264-40.4) Avail: US Patent and Trademark Office CSCL 14B

A method and apparatus are provided for enabling the measurement of the viscosity of substances, especially those containing volatiles at elevated temperatures, with greater accuracy and at less cost than before. The apparatus includes a cylinder with a narrow exit opening at one end and a piston which closely slides within the cylinder to apply force against a sample in the cylinder to force the sample through the exit opening. In order to more rapidly heat a sample the ends of the cylinder and piston are tapered and the sample is correspondingly tapered, to provide a large surface to volume ratio. A corresponding coal sample is formed by compressing particles of coal under high pressure in a mold of appropriate shape.
Official Gazette of the U.S. Patent and Trademark Office

N80-18358* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATIC PRESSURE ORIFICE SYSTEM TESTING METHOD AND APPARATUS Patent
Randolph F. Culotta and Donald L. Posey, inventors (to NASA) Issued 8 Jan. 1980 7 p Filed 17 Aug. 1978 Supersedes N78-33123 (16 - 24, 3179)
(NASA-Case-LAR-12269-1; US-Patent-4,182,158; US-Patent-Appl-SN-934576; US-Patent-Class-73-40; US-Patent-Class-73-4R) Avail: U.S. Patent and Trademark Office CSCL 14B

A method and apparatus are presented for pressure testing the static pressure orifices and associated connections used in wind tunnels. A cylindrical module, having in one end an open hemispherical calibration pressure chamber separated from and surrounded by an annular vacuum chamber is placed over the orifice of the system to be tested. O-rings ensure seating and a vacuum seal between the chambered end of the module and the surface around the orifice: one O-ring separates the outer chamber from the outside environment. Ports lead from each of the chambers out the other end of the module to tubes connected to a control box consisting of calibration pressure and vacuum supply lines, bleeder valves, and gauges.
Official Gazette of the U.S. Patent and Trademark Office

N80-18359* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTED-SWITCH DICKE RADIOMETERS Patent
Curt A. Levis, inventor (to NASA) (Ohio State Univ., Columbus) Issued 11 Dec. 1979 7 p Filed 29 Mar. 1978 Supersedes N78-22436 (16 - 13, p 1714) Sponsored by NASA
(NASA-Case-GSC-12219-1; US-Patent-4,178,100; US-Patent-Appl-SN-891356; US-Patent-Class-356-216; US-Patent-Class-325-363; US-Patent-Class-343-100ME; US-Patent-Class-73-355R) Avail: U.S. Patent and Trademark Office CSCL 14B

A radiometer on an orbiting spacecraft is described which derives high spatial resolution information from terrestrial and atmospheric regions. The N elements or subapertures on the spacecraft transduce electromagnetic energy into electric signals. Many or all of the elements are simultaneously illuminated by electromagnetic energy radiated from the same region. Identical, parallel processing channels are responsive to the N elements. Each of the channels includes a variable gain amplifier responsive to the signal transduced by its corresponding array elements. The gain of each amplifier is controlled as a function of the output difference when the channel is connected periodically to each of a pair of Dicke noise sources, such as resistors maintained at predetermined temperatures.
Official Gazette of the U.S. Patent and Trademark Office

N80-18360*# University of Southern Mississippi, Hattiesburg.
DECONVOLUTION OF GAS CHROMATOGRAPHIC DATA Final Report
Samuel Howard and Grayson H. Rayborn Feb. 1980 79 p refs
(Contract NsG-1380)
(NASA-CR-3229) Avail: NTIS HC A05/MF A01 CSCL 07D

The use of deconvolution methods on gas chromatographic data to obtain an accurate determination of the relative amounts of each material present by mathematically separating the merged peaks is discussed. Data were obtained on a gas chromatograph with a flame ionization detector. Chromatograms of five xylenes with differing degrees of separation were generated by varying the column temperature at selected rates. The merged peaks were then successfully separated by deconvolution. The concept of function continuation in the frequency domain was introduced in striving to reach the theoretical limit of accuracy, but proved to be only partially successful. R.C.T.

N80-18361*# Santa Barbara Research Center, Goleta, Calif.
InSb CHARGE COUPLED INFRARED IMAGING DEVICE: THE 20 ELEMENT LINEAR IMAGER Final Report
R. D. Thom, T. L. Koch, W. J. Parrish, J. D. Langan, and S. C. Chase Feb. 1980 140 p refs
(NASA-CR-3235) Avail: NTIS HC A07/MF A01 CSCL 14B

The design and fabrication of the 8585 InSb charge coupled infrared imaging device (CCIRID) chip are reported. The InSb material characteristics are described along with mask and process modifications. Test results for the 2- and 20-element CCIRID's are discussed, including gate oxide characteristics, charge transfer efficiency, optical mode of operation, and development of the surface potential diagram. K.L.

N80-18362*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF AND MEANS FOR RETARDING DYE FADING DURING ARCHIVAL STORAGE OF DEVELOPED COLOR PHOTOGRAPHIC FILM Patent Application
Richard B. Hoover and Charles M. Rhodes, inventors (to NASA) Filed 7 Feb. 1980 8 p
(NASA-Case-MFS-23250-1; US-Patent-Appl-SN-119340) Avail: NTIS HC A02/MF A01 CSCL 14E

A method for retarding dye fading of developed color photographic film is described. Fading is accomplished by placing the film in a sealed, opaque vault; introducing a dry, pressurized inert gas into the vault while the latter is vented; and sealing the vault after the air within the vault has been purged and replaced by the inert gas. Preferably, the gas is nitrogen; and the vault is stored at a temperature below room temperature to preserve the color photographic emulsions on the film contained within the vault. For short term storage, sodium thiocyanate pads charged with water are placed within the vault. For long term storage, the interior of the vault is kept at a low relative humidity. NASA

N80-18363*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIQUID-IMMERSIBLE ELECTROSTATIC ULTRASONIC TRANSDUCER Patent Application
John H. Cantrell, Jr., Joseph S. Heyman, William T. Yost

(Tennessee Univ.), Michael A. Torbett (Tennessee Univ.), and Mark A. Breazeale, inventors (to NASA) (Tennessee Univ.) Filed 21 Dec. 1979 12 p

(NASA-Case-LAR-12465-1; US-Patent-Appl-SN-106136) Avail: NTIS HC A02/MF A01 CSCL 14B

A broadband megahertz range electrostatic acoustic transducer for use in a liquid environment is described. A liquid-tight enclosure which includes a metallic conducting membrane as part of its outside surface has a means inside the liquid-tight enclosure for applying a tension to the membrane and for mounting an electrode with the flat end approximately parallel to the membrane. A structure for ensuring that the membrane and the flat end of the electrode are exactly parallel and a fixed predetermined distance from each other is included. NASA

N80-18364*# National Aeronautics and Space Administration. Pasadena Office, Calif.

FREQUENCY-SCANNING PARTICLE SIZE SPECTROMETER Patent Application

Alain L. Fymat, inventor (to NASA) (JPL) Filed 10 Aug. 1979 21 p

(Contract NAS7-100)

(NASA-Case-NPO-13606-2; US-Patent-Appl-SN-065676) Avail: NTIS HC A02/MF A01 CSCL 14B

A particle size spectrometer having a fixed field of view within the forward light scattering cone at an angle theta sub s between approximately 100 and 200 minutes of arc (preferably at 150 minutes), a spectral range extending approximately from 0.2 to 4.0 inverse micrometers, and a spectral resolution between about 0.1 and 0.2 inverse micrometers (preferably toward the lower end of this range of spectral resolution), is employed to determine the distribution of particle sizes, independently of the chemical composition of the particles, from measurements of incident light, at each frequency, sigma (= 1/lambda), and scattered light, I(sigma). NASA

N80-18365*# M&S Computing, Inc., Huntsville, Ala.

THE IDENTIFICATION AND CORRECTION OF CHANNEL-TO-CHANNEL PHASE DIFFERENCES WITHIN A DATA PROCESSING SYSTEM Final Report

Hubert M. Horton 2 Jan. 1980 34 p refs

(Contract NAS8-31004)

(Rept-79-077; NASA-CR-161377) Avail: NTIS HC A03/MF A01 CSCL 14C

Data processing hardware was tested in order to determine the sources of channel time delay differences and mathematically characterize the differences. A procedure developed to detect and correct these delay differences was subjected to test data in order to verify its capability. Test results are presented. K.L.

N80-18366*# Energetics Science, Inc., Elmsford, N. Y.

TOXIC LEVEL HYPERGOLIC VAPOR DETECTION SENDOR DEVELOPMENT Final Report

Joseph R. Stetter, Ying-Kit Lau, and Raymond B. Cromer 28 Nov. 1979 116 p

(Contract NAS10-9492)

(NASA-CR-154633; KSC-TR-28-1) Avail: NTIS HC A06/MF A01 CSCL 14B

Development of an electrochemical sensor technology capable of PPB level hypergolic vapor sensing is reported. A portable instrument capable of meeting the design goals is described. J.M.S.

N80-18367*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

INFRARED SCANNER CONCEPT VERIFICATION TEST REPORT

F. D. Bachtel Jan. 1980 66 p

(NASA-TM-78264) Avail: NTIS HC A04/MF A01 CSCL 14B

The test results from a concept verification test conducted to assess the use of an infrared scanner as a remote temperature sensing device for the space shuttle program are presented. The temperature and geometric resolution limits, atmospheric attenuation effects including conditions with fog and rain, and the problem of surface emissivity variations are included. It is concluded that the basic concept of using an infrared scanner to determine near freezing surface temperatures is feasible. The major problem identified is concerned with infrared reflections which result in significant errors if not controlled. Action taken to manage these errors result in design and operational constraints to control the viewing angle and surface emissivity. R.C.T.

N80-18368*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FIBER OPTIC SENSORS FOR MEASURING ANGULAR POSITION AND ROTATIONAL SPEED

Robert J. Baumbick Mar. 1980 13 p

(NASA-TM-81454; E-381) Avail: NTIS HC A02/MF A01 CSCL 20F

Two optical sensors, a 360 deg rotary encoder and a tachometer, were built for operation with the light source and detectors located remotely from the sensors. The source and detectors were coupled to the passive sensing heads through 3.65 meter fiber optic cables. The rotary encoder and tachometer were subjected to limited environmental testing. They were installed on an air breathing engine during recent altitude tests. Over 100 hours of engine operation were accumulated without any failure of either device. K.L.

N80-18369# Aeronautical Research Labs., Melbourne (Australia).

SPECIFICATION FOR THE INSTALLATION OF ELECTRICAL RESISTANCE STRAIN GAUGES ON STRAIN PAIRS COUNTER AIRCRAFT

S. W. Gee Mar. 1979 13 p

(AD-A071363; ARL/Struc-TM-301) Avail: NTIS HC A02/MF A01 CSCL 14/2

A number of RAAF aircraft are to be strain gauged as part of a program designed to monitor the in-flight fatigue damage accumulated by service aircraft during normal squadron usage. Flight strains are to be measured by gauges, strategically placed on the structure and monitored by strain pairs counters. The materials and methods of application recommended in this memo, have been successfully used for flight trials over several years and have proved very reliable. Any deviations from the suggested methods should be thoroughly checked before use on the aircraft. GRA

N80-18370# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.

GIMBAL PICKOFF TECHNOLOGICAL STUDIES

Aubrey Rodgers Aug. 1979 22 p refs

(AD-A076372; DRSMI-T-79-81) Avail: NTIS HC A02/MF A01 CSCL 17/7

The purpose of this study and analysis is to employ more sophisticated gyro gimbal pickoff component technology to replace existing pickoff designs. The existing wide gyro pickoffs experience gimbal wiring and slipring torques, potentiometer wiper lift off during flight environment, noise, increased friction, and assembly cost. The goals of this study are to gain a better understanding of the pickoff error mechanism and to utilize the major advances in component development, materials, and manufacturing techniques as applicability to the design of inertial instruments. GRA

N80-18371# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.

CONSTRUCTION OF A HIGH RESOLUTION HETERODYNE SPECTROMETER FOR MEASUREMENTS OF IN LINE PROFILES MEDIUM INFRARED [AUFBAU EINES HOCHAUFLOESENDEN HETERODYN-SPEKTROMETERS ZUR MESSUNG VON LINIENPROFILEN IM MITTLEREN INFRAROT-BEREICH]

Klaus-Uwe Dettmar May 1979 89 p refs In GERMAN

(MPI-PAE/Extraterr-156; ISSN-0340-8922) Avail: NTIS HC A05/MF A01

The instrument uses a CO2 laser and electric filters to provide a resolution up to 10 to the minus 7th power, and higher sensitivity. The apparatus contains a frequency mixer and employs the laser light like a local oscillator. Measurements taken with acetylene indicate that the instrument will provide useful spectra for work with planetary atmospheres. Author (ESA)

N80-18216 Pacific Missile Test Center, Point Mugu, Calif.

AUTOMATIC ENVIRONMENTAL CONTROL SYSTEM FOR MISSION PROFILE TESTING

Robert Schilken *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 15-23 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18217 Harris Corp., Melbourne, Fla. Electronic Systems Div.
BROAD-BAND MECHANICAL VIBRATION AMPLIFIER
R. T. Fandrich *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 25-31 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18218 Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
STABILITY AND FREQUENCY RESPONSE OF HYDROMECHANICAL SHAKERS IN VIBRATION RIGS
T. Seshadri Sankar *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 33-47 refs Sponsored by the Natl. Res. Council of Canada and the Formation de Chercheurs et d'Action Contertee (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18219 Harris Corp., Melbourne, Fla. Electronic Systems Div.
MIL-STD-781C RANDOM RELIABILITY TESTING PERFORMED BY USING ACOUSTIC COUPLING
S. M. Landre *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 49-56 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18222 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANGULAR VIBRATION MEASUREMENT TECHNIQUES
P. Wayne Whaley and Michael W. Obal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 83-93 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18225 Sandia Labs., Albuquerque, N. Mex.
A NON-CONTRACTING BETA BACKSCATTER GAGE FOR EXPLOSIVE QUANTITY MEASUREMENT
P. B. Higgins, F. H. Mathews, and R. A. Benham *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 113-126 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18226 Air Force Weapons Lab., Kirtland AFB, N. Mex. Civil Engineering Research Div.
DATA ACQUISITION FOR THE IMMEDIATE FUTURE
Josef F. Schneider *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 127-137 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-18372* National Aeronautics and Space Administration. Pasadena Office, Calif.
DIELECTRIC-LOADED WAVEGUIDE CIRCULATOR FOR CRYOGENICALLY COOLED AND CASCADED MASER WAVEGUIDE STRUCTURES Patent
Robert C. Clauss (JPL) and Rex B. Quinn, inventors (to NASA) (JPL) Issued 5 Feb. 1980 6 p Filed 9 Feb. 1978 Supersedes N78-22359 (16 - 13, p 1703) Sponsored by NASA
(NASA-Case-NPO-14254-1; US-Patent-4,187,470;
US-Patent-Appl-SN-876432; US-Patent-Class-330-4;
US-Patent-Class-331-94; US-Patent-Class-333-24R) Avail: US Patent and Trademark Office CSCL 20E

A dielectrically loaded four port waveguide circulator is used with a reflected wave maser connected to a second port between first and third ports to form one of a plurality of cascaded maser waveguide structures. The fourth port is connected to a waveguide loaded with microwave energy absorbing material. The third (output signal) port of one maser waveguide structure is connected by a waveguide loaded with dielectric material to the first (input) port of an adjacent maser waveguide structure, and the second port is connected to a reflected wave maser by a matching transformer which passes the signal to be amplified into and out of the reflected wavemaser and blocks pumping energy in the reflected wave maser from entering the circulator. A number of cascaded maser waveguide structures are thus housed in a relatively small volume of conductive material placed within a cryogenically cooled magnet assembly.

Official Gazette of the U.S. Patent and Trademark Office

N80-18373 California Univ., San Diego.
NECESSARY CONDITIONS FOR THE HOMOGENEOUS FORMATION OF A VOLUME AVALANCHE DISCHARGE WITH SPECIFIC APPLICATIONS TO RARE GAS-HALIDE EXCIMER LASER DISCHARGES Ph.D. Thesis
Jeffrey Ian Levatter 1979 153 p
Avail: Univ. Microfilms Order No. 8002939

The phenomena involved in high E/n (electric field to gas number density ratio) breakdown and its relationship to the formation of spatially homogeneous discharges is considered. Assuming uniform field electrodes with no edge effects, the minimum preionization density required for homogeneous discharge initiation is found to depend on the voltage rise time across the electrodes as well as on the total gas pressure and various electrochemical properties of the gas mixture. A large volume avalanche dicharge laser was constructed which employs an 1 X-ray preionization scheme to obtain the required spatially uniform volume preionization. Using X-rays as an ionizing agent, spatially homogeneous pulsed avalanche discharges of several liter volume at several atmosphere pressure for up to 100-nesec duration were successfully generated. In concurrent laser generation experiments, high-optical-quality pulsed UV laser output up to 2.5 J/liter from such discharges in rare gas/halogen mixtures, and ir laser output of up to 12.5 J/liter from a He/N2/CO2 mixture were observed. Dissert. Abstr.

N80-18374 Texas A&M Univ., College Station.
EXCITED STATES OF RUBIDIUM POPULATED BY STEPWISE EXCITATION USING A RUBIDIUM LAMP AND/OR A TUNABLE DYE LASER: IMPORTANCE OF REDISTRIBUTION COLLISIONS Ph.D. Thesis
Ralph Henry Hill, Jr. 1979 133 p
Avail: Univ. Microfilms Order No. 8003147

Excited states of rubidium were populated by using a stepwise excitation scheme. The first step is either a transition to an atomic intermediate state using a rubidium resonance lamp, or a transition to a molecular intermediate state using a laser as the excitation source. The second step in both cases is accomplished using a laser to populate high states in the rubidium atom. Two different commercial lasers were used and the results were compared. One laser is a single mode laser whereas the other is a multimode laser. Once the excited states are populated, the importance of collisions with ground state rubidium atoms is investigated. Angular momentum changing collision cross sections are investigated. Dissert. Abstr.

N80-18375 Illinois Univ. at Urbana-Champaign.
LASER MELTING AND SUBSEQUENT SOLIDIFICATION OF A SURFACE LAYER Ph.D. Thesis
Shin-Chen Hsu 1979 224 p
Avail: Univ. Microfilms Order No. 8004193

The effect of stationary and moving high intensity heat fluxes, achieved by laser or electron beam radiation, on the surface melting and subsequent solidification variables of metallic substrates was investigated. The problems considered are the rapid melting and solidification of the surface layer of a semi-infinite solid subjected to: (1) step function stationary uniform heat flux over a circular region on its bounding surface when heat flow conditions are almost unidirectional; (2) step function stationary uniform and Gaussian heat flux distributions over a circular region on its bounding surface when heat flow is two-dimensional; and (3) uniform and Gaussian heat flux distributions over a circular region on its bounding surface moving with a constant velocity, U, in the y-direction. Microstructural observations made on an Al-4.5% Cu alloy substrate are described and the findings are compared with the general trends established in the quasisteady state moving flux calculations. Dissert. Abstr.

N80-18376 State Univ. of New York at Stony Brook.
STUDIES IN ONE BEAM LASER SPECKLE INTERFEROMETRY Ph.D. Thesis
Gopal Krishan Jaisingh 1979 215 p
Avail: Univ. Microfilms Order No. 8004408

Topics covered include: (1) the motion of subjective speckles; (2) the upper bound of the one beam method; (3) the effects of an axial movement of the filtering aperture from its usual Fourier plane position on the wholefield filtering method; (4) a technique to determine surface contours of three dimensional objects; (5) a method to determine in-plane and out of plane displacement of a surface simultaneously by combining the one beam speckle method with projection moire; (6) determining displacements at the interior of three dimensional transparent objects using speckles produced by the scattered laser light; (7) fringe sharpening and (8) extension of the two beam method to three beams. Dissert. Abstr.

N80-18377 Illinois Univ. at Urbana-Champaign.
MULTIPHOTON CONTRIBUTIONS TO FAR INFRARED GENERATION IN OPTICALLY PUMPED DEUTERIUM OXIDE Ph.D. Thesis
Samuel Judah Petuchowski 1979 172 p
Avail: Univ. Microfilms Order No. 8004253

Far Infrared (FIR) emission at 66 and 50 microns in D2O vapor, optically pumped with a CO2 TEA laser, is shown to constitute a stimulated Raman process associated with each wave within a system of four molecular vibrational-rotational levels. A propagation model, based on a semiclassical, quasistatic density matrix analysis, is constructed and applied to the system. The model is generalized to include one-, two-, and three-wave interactions among three near-resonant waves of arbitrary intensity in a variety of four-level system configurations. Agreement between the model calculations and empirical data is shown with respect both to FIR temporal behavior and to 66 micron pulse energy vs. D2O pressure and pump intensity. Explicit account is taken of inhomogeneous broadening of the pump transition at lower D2O pressures. Various hypotheses are considered to explain the singular failure of the model to account for the observed 50 micron intensity. Dissert. Abstr.

N80-18378# Illinois Univ., Urbana. Aeronomy Lab.
A MICROCOMPUTER CONTROL SYSTEM FOR THE URBANA SODIUM LIDAR
K. Teitelbaum and C. F. Sechrist, Jr. 1 Jun. 1979 131 p
(Grant NSF ATM-78-12308)
(UILU-ENG-79-2507; ISSN-0508-0581; Aeronomy-88) Avail: NTIS HC A07/MF A01

The design, fabrication, and testing of a microcomputer control system for the Urbana lidar is described. Calibration of the lidar system against Rayleigh scattering returns is considered, and altitude profile of the mesospheric sodium concentration is presented. R.C.T.

N80-18379# Materials Research Labs., Melbourne (Australia).
A 30-kW CO2 MIXING LASER
Ross C. McLeary, Russell E. Whitcher, and Peter J. Beckwith Jun. 1979 22 p refs
(MRL-R-751; AR-001-830) Avail: NTIS HC A03/MF A01

A convectively cooled, continuous wave mixing laser is described which is simple, robust, and reliable, and can be manufactured in a workshop with standard machining facilities. High pressure discharges are stabilized by pre-ionizing the gas flow by passing it through an array of subsidiary arc discharges. Flowing nitrogen, at a pressure of 120 kPa is electrically excited before passing through a restriction into a region of high pressure (20 kPa), where it is mixed with CO2. A small quantity of helium is added to depopulate the lower laser level and the optical power is extracted by means of a resonator situated downstream of the mixing system. The laser is operated in a blow down mode in which the gases are initially stored in pressure vessels and subsequently flow through the laser into a vacuum task. The plasma injection technique produced a laser with an output power of 30 kW at an efficiency rate of 9 percent. A.R.H.

N80-18380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER MEASURING SYSTEM FOR INCREMENTAL ASSEMBLIES Patent Application
James A. Munford and John G. Etzel, inventors (to NASA) Filed 7 Dec. 1979 14 p
(NASA-Case-GSC-12321-1; US-Patent-Appl-SN-102001) Avail: NTIS HC A02/MF A01 CSCL 20E

Incremental assemblies such as wire-wrapped frame assemblies used in spark chambers and the like are precisely measured using a system which includes a laser, an interferometer, and a retroreflector. A light source and a photodetector are located adjacent to the incremental assembly and mounted on a movable carriage. The interferometer is also mounted on the movable carriage, while the laser and retroreflector are positioned at either end of the carriage track. The carriage is moved along one edge of the incremental assembly between the retroreflector and the laser, and as the carriage is moved, the light from the light source to the photodetector is interrupted. This produces a trigger command to a control unit which in turn causes a distance measurement to be made. A printout is provided for each sampling trigger command to list such items as ideal position, actual position and amount of error. NASA

N80-18381*# National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGH POWER METALLIC HALIDE LASER Patent Application
Thomas J. Pivirotto, inventor (to NASA) (JPL) Filed 7 Feb. 1980 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14782-1; US-Patent-Appl-SN-119339) Avail: NTIS HC A02/MF A01 CSCL 20E

A high power metallic halide (CU3C13) laser capable of providing 300 watts of output power is disclosed. More specifically it is a laser amplification system and a heat exchanger in a closed loop system. In addition, a molecular dissociation apparatus is provided at the input to the laser amplifier for dissociating the copper chloride into copper atoms and ions and chlorine atoms and ions. The dissociation apparatus includes a hollow cathode tube and an annular ring spaced apart from the tube end. A voltage differential is applied between the annular ring and the hollow cathode tube so that as the copper chloride flows therethrough, it is dissociated into copper and chlorine ions and atoms. NASA

N80-18382*# Airborne Instruments Lab., Melville, N. Y.
APPLICATION OF TUNABLE DIODE LASERS AS LOCAL OSCILLATORS IN AN INFRARED HETERODYNE RADIOMETER (IHR) Final Report
M. G. Savage, R. C. Augeri, and B. J. Peyton Dec. 1979 95 p refs
(Contract NAS1-14362)
(NASA-CR-159121) Avail: NTIS HC A05/MF A01 CSCL 20E

The utility of diode lasers as local oscillators (LOs) in a heterodyne receiver application was investigated. The CW power, spectral tunability, spectral stability, and spatial intensity distribution of the TDL outputs were measured. A tunable diode laser LO was incorporated into a laboratory Dicke-switched infrared heterodyne setup and used to measure radiometer sensitivity as well as spectroscopic characteristics of selected absorption lines of ammonia. The test results on one of the two tunable diode lasers are emphasized in an attempt to provide a comprehensive data package which may be useful for future planning purposes. The second tunable diode laser exhibits characteristics similar to the fully tested TDL with the exception that some changes in its performance characteristics as it was temperature cycled between room temperature and the operating temperature of approximately 50K occurred. A.R.H.

N80-18383*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
TUNABLE DIODE LASER HETERODYNE RADIOMETER MEASUREMENT OF ATMOSPHERIC ABSORPTION OF

SOLAR RADIATION Final Report, 15 Oct. 1977 - 14 Dec. 1979
Charles N. Harward and Gary E. Copeland Mar. 1980 55 p refs
(Grant NsG-1466)
(NASA-CR-162827; PTR-80-3) Avail: NTIS HC A04/MF A01 CSCL 20E

A tunable infrared heterodyne radiometer (TIHR) which uses a diode laser as the local oscillator is described as well as methods for the evaluation of the excess noise characteristics of the tunable diode laser. Preliminary atmospheric absorption data taken with the TIHR are presented and show the capability of the TIHR for making the highest resolution atmospheric measurements to date. A.R.H.

N80-18384# JAYCOR, Alexandria, Va.
THE NON-LINEAR THEORY OF FREE ELECTRON LASERS AND EFFICIENCY ENHANCEMENT
P. Sprangle, Cha-Mfi Tang, and W. M. Manheimer Washington, D.C. Wave Research Lab. 28 Sep. 1979 54 p refs
(DARPA Order 3817; RR011941)
(AD-A075063; NRL-MR-4034) Avail: NTIS HC A04/MF A01 CSCL 20/5

The development of lasers in which the active medium is a relativistic stream of free electrons has recently evoked much interest. The potential advantages of such free electron lasers include, among other things, continuous frequency tunability, very high power of operations and high efficiency. The free electron laser is characterized by a pump field; for example, a spatially periodic magnetic field, which scatters from a relativistic electron beam. The scattered radiation has a wavelength much smaller than the pump wavelength depending on the electron beam energy. We present a general self-consistent non-linear theory of the free electron laser process. The non-linear formulation of the temporal steady state free electron laser problem results in a set of coupled differential equations governing the spatial evolution of the amplitudes and wavelength of the radiation and space charge fields. These equations are readily solved numerically since the amplitude and wavelength vary on a spatial scale which is comparable to a growth length of the output radiation. A number of numerical/analytical illustrations are presented ranging from the optical to the submillimeter wavelength regime. Our non-linear formulation in the linear regime is compared with linear theory and agreement is found to be excellent. Analytical expressions for the saturated efficiency and radiation amplitude are also shown to be in very good agreement without non-linear numerical solutions. Efficiency curves are obtained for both the optical and submillimeter FEL examples with fixed magnetic pump parameters. We show that these intrinsic efficiencies can be greatly enhanced by appropriately contouring the magnetic pump period. GRA

N80-18385# Defence Research Establishment Valcartier (Quebec).
PERFORMANCE AND DIAGNOSTICS OF LASERS INITIATED BY THE REACTION OF NO WITH ClO2
S. J. Arnold, K. D. Foster, and D. R. Snelling Sep. 1979 25 p refs
(AD-A076010; DREV-R-4144/79) Avail: NTIS HC A02/MF A01 CSCL 20/5

A purely chemical HCl laser employing transverse flow was operated with a maximum multiline output power of 13 W, which represents a chemical efficiency of 8.6% based on the total exothermicity of the pumping reaction. The required nonequilibrium concentration on Cl atoms was generated by the branched-chain reaction of NO with ClO2. Mass spectrometric and absorption spectroscopic measurements of species concentrations in the NO/ClO2 reaction system showed that the effectiveness of production of the branched chain decreased with increasing total pressure. GRA

N80-18386# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
CHEMICAL LASER SYSTEMS: AN ENGINEERING APPROACH. VOLUME 1: CHEMICAL LASER ANALYSIS PROGRAM
Clark D. Mikkelsen and Billy J. Walker 31 Jan. 1979 321 p
(DA Proj. 1L1-61102-AH-49)
(AD-A075476; DRSMI-T-79-24-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 20/5

The Chemical Laser Analysis Program presented in this report is a computer program for the rapid, parametric evaluation of high energy, chemical laser systems, including the combustion chemistry, laser devices gas dynamics, various diffuser-ejector pressure recovery subsystems, and system volume/mass estimates. The program does not calculate specific laser power but relies on experimental data for scaling information. The FORTRAN EXTENDED computer program listing, as well as detailed information on program development, organization, and operating procedure are given along with a complete program nomenclature and two sample cases. GRA

N80-18387# Naval Research Lab., Washington, D. C. Plasma Physics Div.
METHODS OF EFFICIENCY ENHANCEMENT AND SCALING FOR THE GYROTRON OSCILLATOR Interim Report
K. R. Chu, M. E. Read, and A. K. Ganguly Sep. 1979 29 p refs
(Contract DE-AC01-79ET-52053)
(AD-A075133; NRL-MR-4051) Avail: NTIS HC A03/MF A01 CSCL 20/5

It is shown that a gyrotron oscillator operating in a slightly tapered magnetic field can attain an efficiency of about 78%, approximately 1.7 times higher than that obtainable in a constant magnetic field. Extensive numerical data have been tabulated and a convenient parameter is introduced to generate numerical efficiency scaling relations through which optimum operating conditions are clearly exhibited. Conditions for reaching the high efficiency operating regime have also been studied and are numerically illustrated. GRA

N80-18388# Avco-Everett Research Lab., Mass.
FLAMEOUT AND ACOUSTIC DAMPING IN PULSED CHEMICAL LASERS Final Report
R. Limpaecher Jun. 1979 143 p refs
(Contract N00173-76-C-0162; DARPA Order 3016)
(AD-A076124) Avail: NTIS HC A07/MF A01 CSCL 20/5

The objective of this program was to address the acoustic damping issue of a repetitively-pulsed atmospheric pressure pulsed chemical laser. For this purpose a device, one meter in size parallel to the optical axis, was designed and constructed. To achieve flameout 80 fluidic devices were used to control the hydrogen flow. A new mixer was fabricated to obtain the required medium quality using a photochemical machining technique. For the acoustic quieting a heat exchanger was used to reduce the acoustic reflection of the hot-cold gas interfaces, and a muffler type acoustic absorber was constructed for acoustic energy attenuation. The results of a limited test period have been described. GRA

N80-18389# Michigan Univ., Ann Arbor. College of Engineering.
THEORETICAL STUDIES OF LASER LIGHT INTERACTION AND OPTICAL AND X-RAY EMISSION FROM DENSE METALLIC PLASMAS Final Report, 1 Aug. 1975 - 1 Oct. 1979
J. J. Duderstadt and R. S. B. Ong Nov. 1979 55 p refs
(Grant AF-AFOSR-2904-76; AF Proj. 2301)
(AD-A078684; AFOSR-79-1303TR) Avail: NTIS HC A04/MF A01

The interaction of a high power CO2 laser with a dense plasma is investigated. Stimulated Brillouin scattering and thermal self-focusing of the incident beam is studied. The dynamics of a strongly turbulent plasma generated by laser-plasma interaction, and the behavior of nonlinear waves (solitons) in the plasma is analyzed. Advanced MHD plasma simulation models are employed to study the complex dynamics of nonequilibrium plasmas interacting with laser radiation. MHD computer codes capable of simulating exploding wire or pinch dynamics subjected to intense laser irradiation are developed. Radiation transport effects, such as X-ray line emission and re-absorption in optically thick regions of the plasma, are incorporated in the MHD computer code. GRA

N80-18390# Avco-Everett Research Lab., Mass.
INVESTIGATION OF OPTIMUM LASER PUMPING Final

Report, 16 Aug. 1974 - 31 Jul. 1979
J. H. Jacob, R. Brochu, A. Hawryluk, J. Hsia, and M. Rokni
Nov. 1979 95 p refs
(Contract N00014-75-C-0062; DARPA Order 3500)
(AD-A078974) Avail: NTIS HC A05/MF A01 CSCL 20/5

The objective of this program is to characterize the performance of various laser candidate systems so that reliable projections of their usefulness for long-range DARPA missions can be properly assessed. This final report highlights the accomplishments attained under this contract and summarizes these results obtained in the interim period since the last semiannual technical report. These include: (1) an attachment rate constant determination for the reaction e plus Cl2, (2) kinetic quenching measurements and role of the B- and C- states in XeF^*, (3) some preliminary results on active medium absorption in XeF^* laser mixtures, (4) the effect of the ground state population on the XeF laser performance; and (5) a detailed model of e-beam pumped KrF^* laser. GRA

N80-18391# Southern Methodist Univ., Dallas, Tex.
DESIGN OF INJECTION LASERS FOR IMPROVED RADIATION PERFORMANCE Final Report, 23 Feb. 1976 - 22 Feb. 1979
Jerome K. Butler 14 Nov. 1979 111 p refs
(Grant DAAG29-76-G-0146; DA Proj. 1T1-61102-BH-57)
(AD-A078519; ARO-13568.9-EL) Avail: NTIS HC A06/MF A01 CSCL 20/9

This research was concerned with (1) the electromagnetic modes and (2) the radiation pattern characteristics of contemporary injection laser structures. The objective was to investigate laser structures which can produce stable-beam radiation patterns. The control of lateral fields in lasers has been accomplished with many novel devices such as the channeled-substrate-planar, buried heterostructure and strip-loaded waveguide. The drawback to the stripe laser is that it is laterally unstable. Much of our work has been aimed at rigorously modeling the electromagnetic modes of stripe lasers. We have also applied our analysis to other lasers such as the channeled-substrate-planar device. GRA

N80-18392# Defence Research Information Centre, Orpington (England).
THE THEORY OF OPTICAL RESONATORS
L. Ronchi (CNR, Florence) Jun. 1979 24 p refs Transl. into ENGLISH from Alta Frequenza (Italy), v. 47, no. 6, 1978 p 468-474
(DRIC-Trans-5616; BR68834) Avail: NTIS HC A02/MF A01

The operating principles of optical resonators are examined, focusing on unstable resonators used in the field of high power lasers. The main characteristic discussed is that every mode occupies the whole volume at its disposal and in particular, the volume of the active material. This is related to the control of lateral modes. Theory predicts that the connection with external space can be exploited by using the radiation spillover which generally corresponds with a fairly regular near field. It is noted that reported experimental results on unstable resonators agree well with the presented theoretical analysis regarding field distributions and connection with outside space. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-18393* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CRYOGENIC CONTAINER COMPOUND SUSPENSION STRAP Patent
John W. Vorreiter, inventor (to NASA) Issued 22 Jan. 1980 5 p Filed 22 Aug. 1978 Supersedes N79-18087 (17 - 09, p 1109)
(NASA-Case-ARC-11157-1; US-Patent-4,184,609;
US-Patent-Appl-SN-935827; US-Patent-Class-220-445;
US-Patent-Class-220-423; US-Patent-Class-220-901) Avail: US Patent and Trademark Office CSCL 13I

A support strap for use in a cryogenic storage vessel for supporting the inner shell from the outer shell with a minimum heat leak is presented. The compound suspension strap is made from a unidirectional fiberglass epoxy composite material with an ultimate tensile strength and fatigue strength which are approximately doubled when the material is cooled to a cryogenic temperature.
Official Gazette of the U.S. Patent and Trademark Office

N80-18394 Illinois Univ. at Urbana-Champaign.
COMBUSTION SIMULATION OF A DUAL CHAMBER STRATIFIED CHARGE SPARK IGNITION ENGINE Ph.D. Thesis
Samuel Shangchi Pan 1979 210 p
Avail: Univ. Microfilms Order No. 8004247

A one-dimensional mathematical model was developed which includes the submodels of ignition, mixing; chemical kinetics, heat transfer, turbulent diffusivity, and NO formation. Studies are made on the basic parameters, such as the turbulence level, the preexponential constant, the heat transfer, the mixing percentage, the total air fuel ratio, the prechamber intake air fuel ratio, the prechamber intake mass flow ratio, the volumetric efficiency, the throat diameter, and the spark location and timing. The calculated results correlate well with the experimental data. All the predicted trends agree with the experimental trends over the range of the engine conditions investigated. Dissert. Abstr.

N80-18395 Tennessee Technological Univ., Cookeville.
IDENTIFICATION OF NOISE SOURCES IN FC CENTRIFUGAL FAN ROTORS Ph.D. Thesis
David Raj 1978 263 p
Avail: Univ. Microfilms Order No. 8004108

The sources of broad band noise in forward curved centrifugal fan rotors were studied using a 10.6 inch diameter fan. The flow field inside the fan was observed using flow visualization techniques. The velocity and velocity fluctuations of the rotor exit flows were measured using a hot-wire anemometer. The blade-to-blade variation of the absolute velocity, both magnitude and direction, and the high level of velocity fluctuations made it necessary to develop a special sampling system for the velocity measurements. This system was successfully used to measure the rotor exit velocity levels. The separated flow over the blade suction surface was the major broad band noise source. The presence of circumferential and axial gradients in the mean flow also contributed to the problem. The rotor blades must be redesigned to eliminate the flow separation over the suction surfaces. Dissert. Abstr.

N80-18396*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLARED TUBE ATTACH SYSTEM Patent Application
Innis D. Alkire (Rockwell International Corp., Houston, Tex.) and Julian P. King, Jr., inventors (to NASA) (Rockwell International, Houston, Tex.) Filed 18 Jan. 1980 16 p Sponsored by NASA
(NASA-Case-MSC-18416-1; US-Patent-Appl-SN-113017) Avail: NTIS HC A02/MF A01 CSCL 13I

A flared tube connection is described. It can be disassembled and assembled in a nondestructive manner without wasting, discarding, or damaging any of its parts or any portion of the associated tubing and parts to which it is joined, and features a split ferrule which may be installed or removed in situ and used to couple fluid lines without the necessity of a permanently installed coupling nut. NASA

N80-18397*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERNAL COMBUSTION ENGINE WITH ELECTROSTATIC DISCHARGING FUELS Patent Application
James B. Stephens (JPL) and Charles G. Miller, inventors (to NASA) (JPL) Filed 18 Sep. 1979 16 p Sponsored by NASA
(NASA-Case-NPO-13798-2; US-Patent-Appl-SN-076635) Avail: NTIS HC A02/MF A01 CSCL 21A

An internal combustion engine system is disclosed in which a mixture of air and fuel droplets which are electrostatically charged to a selected polarity, e.g., negative, is fed to the engine's chambers. The fuel droplets are of uniform size in the micron range, and tend to be uniformly distributed in each chamber. Each chamber includes an electrode which, at a particular point in the engine's cycle of operation, is electrically connected to a potential of a polarity opposite the polarity of the fuel droplets' charge to initiate electrostatic discharging of the droplets. The discharging produces sparks which initiate the combustion of the fuel droplets. Due to electrically insulating matter in the chambers' walls the charged droplets prior to combustion are repelled away from the walls to minimize combustion quenching. NASA

N80-18398*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THERMAL BARRIER SEAL Patent Application
Milo Surbat (Rockwell International Corp., Downey, Calif.) and John O. Kane, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 10 Mar. 1980 16 p Sponsored by NASA
(NASA-Case-MSC-18390-1; US-Patent-Appl-SN-092170) Avail: NTIS HC A02/MF A01 CSCL 11A

A thermal barrier for providing thermal sealing in an elongated space of varying width between adjacent surfaces of first and second members mounted for at least limited movement relative to each other is disclosed. The barrier may include an elongated envelope formed by an elongated sheet of fibrous material centrally and longitudinally folded to provide trailing and leading edges of the barrier. An elongated rigid support plate, the contour of which conforms to the contour of the adjacent surface of one of the members, may be enclosed in the envelope. An elongated core may be confined within the envelope near its leading edge between the rigid support plate and the inner surface of the other side of the envelope. The core is deformable to accommodate the varying width of the elongated space while still maintaining thermal sealing contact between the barrier and the adjacent surfaces of the first and second members. NASA

N80-18399*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOVING BODY VELOCITY ARRESTING LINE Patent Application
Reid A. Hull, inventor (to NASA) Filed 28 Dec. 1979 11 p
(NASA-Case-LAR-12372-1; US-Patent-Appl-SN-108107) Avail: NTIS HC A02/MF A01 CSCL 13H

A method for arresting a moving body using steel cables that elongate to absorb kinetic energy is presented. A sleeve surrounding the cables protects them from chafing and provides an energy absorbing system should the cables fail. NASA

N80-18400*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS PATH SEAL Patent Application
Robert C. Bill and Robert D. Johnson, inventors (to NASA) Filed 20 Nov. 1979 8 p
(NASA-Case-NPO-12131-3; US-Patent-Appl-SN-096255) Avail: NTIS HC A02/MF A01 CSCL 20A

A gas path seal suitable for use with a turbine engine or compressor is described. A shroud wearable or abradable by the abrasion of the rotor blades of the turbine or compressor shrouds the rotor bades. A compliant backing surrounds the shroud. The backing is a yieldingly deformable porous material covered with a thin ductile layer. A mounting fixture surrounds the backing. NASA

N80-18401*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL Patent Application
L. P. Ludwig, inventor (to NASA) Filed 7 Dec. 1979 8 p
(NASA-Case-LEW-12119-2; US-Patent-Appl-SN-102004) Avail: NTIS HC A02/MF A01 CSCL 20A

A circumferential shaft seal in which the seal elements are capable of adequate response to shaft motion is described. The seal is comprised of two sealing rings held to a rotating shaft by means of a surrounding elastomeric band. The rings are segmented and have an inner diameter dimensioned so that the segments can slidably and sealably engage the shaft. Alternative embodiments of the seal concept are described and suggestions for component materials are given. M.G.

N80-18402*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPROVED TIRE/WHEEL CONCEPT Patent Application
Philip M. Harper, Sr., inventor (to NASA) (Boeing Commercial Airplane Co., Seattle, Wash.) Filed 12 Dec. 1979 12 p Sponsored by NASA
(NASA-Case-LAR-11695-2; US-Patent-Appl-SN-103836) Avail: NTIS HC A02/MF A01 CSCL 01C

A tire and wheel assembly is described which consists of a low profile pneumatic tire with sidewalls that deflect inwardly under a load and a wheel having a narrow central channel and extended rim flanges. The extended rim flanges support the tire sidewalls under static and dynamic loading conditions to produce a combination particularly suited to aircraft applications. NASA

N80-18403*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL SPUR GEAR TOOTH TEMPERATURE AS AFFECTED BY OPERATING VARIABLES
Dennis P. Townsend and Lee S. Akin (Western Gear Corp., Industry, Calif.) 1980 29 p refs Presented at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81419; E-342) Avail: NTIS HC A03/MF A01 CSCL 13I

A gear tooth temperature analysis was performed using a finite element method combined with a calculated heat input, calculated oil jet impingement depth, and estimated heat transfer coefficients. Experimental measurements of gear tooth average surface temperatures and instanteous surface temperatures were made with a fast response infrared radiometric microscope. Increased oil jet pressure had a significant effect on both average and peak surface temperatures at both high load and speeds. Increasing the speed at constant load and increasing the load at constant speed causes a significant rise in average and peak surface temperatures of gear teeth. The oil jet pressure required for adequate cooling at high speed and load conditions must be high enough to get full depth penetration of the teeth. Calculated and experimental results were in good agreement with high oil jet penetration but showed poor agreement with low oil jet penetration depth. Author

N80-18404*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A HIGH PERFORMANCE FIXED-RATIO TRACTION DRIVE
Stuart H. Loewenthal, Neil E. Anderson, and Douglas A. Rohn 1980 32 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81425; E-349) Avail: NTIS HC A03/MF A01 CSCL 13I

The results of a test program to evaluate a compact, high performance, fixed ratio traction drive are presented. This transmission, the Nasvytis Multiroller Traction Drive, is a fixed ratio, single stage planetary with two rows of stepped planet rollers. Two versions of the drive were parametrically tested back-to-back at speeds to 73,000 rpm and power levels to 180 kW (240 hp). Parametric tests were also conducted with the Nasvytis drive retrofitted to an automotive gas turbine engine. The drives exhibited good performance, with a nominal peak efficiency of 94 to 96 percent and a maximum speed loss due to creep of approximately 3.5 percent. Author

N80-18405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENDURANCE AND FAILURE CHARACTERISTICS OF MODIFIED VASCO X-2, CBS 600 AND AISI 9310 SPUR GEARS
Dennis P. Townsend and E. V. Zaretsky 1980 28 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81421; E-344) Avail: NTIS HC A03/MF A01 CSCL 13I

Gear endurance tests and rolling-element fatigue tests were conducted to compare the performance of spur gears made from AISI 9310, CBS 600 and modified Vasco X-2 and to compare the pitting fatigue lives of these three materials. Gears manufactured from CBS 600 exhibited lives longer than those manufactured from AISI 9310. However, rolling-element fatigue tests resulted in statistically equivalent lives. Modified Vasco X-2 exhibited statistically equivalent lives to AISI 9310. CBS 600 and modified Vasco X-2 gears exhibited the potential of tooth fracture occurring at a tooth surface fatigue pit. Case carburization of all gear surfaces for the modified Vasco X-2 gears results in fracture at the tips of the gears. Author

N80-18406*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF GEOMETRY AND OPERATING CONDITIONS ON SPUR GEAR SYSTEM POWER LOSS

Neil E. Anderson and Stuart H. Loewenthal 1980 31 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81426; E-350; AVRADCOM-TR-80-C-2) Avail: NTIS HC A03/MF A01 CSCL 20I

The results of an analysis of the effects of spur gear size, pitch, width, and ratio on total mesh power loss for a wide range of speeds, torques, and oil viscosities are presented. The analysis uses simple algebraic expressions to determine gear sliding, rolling, and windage losses and also incorporates an approximate ball bearing power loss expression. The analysis shows good agreement with published data. Large diameter and fine pitched gears had higher peak efficiencies but low part load efficiency. Gear efficiencies were generally greater than 98 percent except at very low torque levels. Tare (no-load) losses are generally a significant percentage of the full load loss except at low speeds. Author

N80-18407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONSTRAINED FATIGUE LIFE OPTIMIZATION OF A NASVYTIS MULTIROLLER TRACTION DRIVE

John J. Coy, Douglas A. Rohn, and Stuart H. Loewenthal 1980 20 p refs Proposed for presentation at 3d Intern. Power Transmission and Gearing Conf., San Francisco, Calif., 18-22 Aug. 1980; sponsored by Am. Soc. of Mech. Engr.
(NASA-TM-81447; AVRADCOM-TR-80-C-6; E-214) Avail: NTIS HC A02/MF A01 CSCL 13I

A contact fatigue life analysis method for multiroller traction drives is presented. The method is based on the Lundberg-Palmgren analysis method for rolling element bearing life prediction, and also uses life adjustment factors for materials, processing, lubrication, and effect of traction. The analysis method is applied in an optimization study to the multiroller traction drive, consisting of a single-stage planetary configuration with two rows of stepped planet rollers of five rollers per row. The drive was approximately 25 centimeters in diameter by 11 centimeters long, having a nominal ratio of 15:1. The theoretically predicted drive life was 2510 hours at a nominal continuous power and speed of 74.6 kW (100 hp) and 7500 rpm. Author

N80-18408*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS AND DESIGN OF A UNIFORM-CLEARANCE, PUMPING-RING ROD SEAL FOR THE STIRLING ENGINE

I. Etsion Mar. 1980 30 p refs
(NASA-TM-81463; E-080) Avail: NTIS HC A03/MF A01 CSCL 11A

A uniform clearance pumping ring, as opposed to the conventional taper clearance one, is described. The uniform clearance concept eliminates complex elastohydrodynamic problems and enables a simple analytical treatment to be made. An analytical expression is derived for the pumping rate showing the effect of various design parameters on the pumping ring's performance. An optimum clearance is found by which the pumping rate is maximized and a numerical example is presented to demonstrate the potential of the uniform clearance design. Author

N80-18409*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME LIMITATIONS IN APPLYING CLASSICAL EHD FILM-THICKNESS FORMULAE TO A HIGH-SPEED BEARING

John J. Coy and Erwin V. Zaretsky 1980 32 p refs Proposed for presentation at Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by Am. Soc. of Mech. Engr. and Am. Soc. of Lubrication Engr.
(NASA-TM-81431; AVRADCOM-TR-80-C-3; E-198) Avail: NTIS HC A03/MF A01 CSCL 13I

Elastohydrodynamic film thickness was measured for a 20 mm ball bearing using the capacitance technique. The bearing was thrust loaded to 90, 448, and 778 N. The corresponding maximum stresses on the inner race were 1.28, 2.09, and 2.45 GPa. Test speeds ranged from 400 to 14,000 rpm. Film thickness measurements were taken with four different lubricants: (1) synthetic paraffinic; (2) synthetic paraffinic with additives; (3) neopentylpolyol (tetra) ester; and (4) synthetic cycloaliphatic hydrocarbon traction fluid. The test bearing was mist lubricated. Test temperatures were 300, 338, and 393 K. The measured results were compared to theoretical predictions and are presented. A.W.H.

N80-18410# Pennsylvania State Univ., University Park. Applied Research Lab.

HANDBOOK OF VIBRATION AND NOISE CONTROL Final Report

J. C. Snowdon 27 Apr. 1979 204 p refs
(Contract N00024-79-C-6043)
(AD-A071485; ARL/PSU-TM-79-75) Avail: NTIS HC A10/MF A01 CSCL 20/11

The static and dynamic properties of rubberlike materials are reviewed initially, followed by discussion of the simple and compound mounting systems. Reference is also made to the dynamic vibration absorber and to the measurement of mount transmissibility. Three sections then describe the natural frequencies, the mechanical impedances, and the transmissibility of structural members. Finally, four-pole parameter analyses are reviewed and the relative transmissibility of various mounting systems supported by a variety of non-rigid foundations is discussed. GRA

N80-18411# Engineering Development Establishment, Maribyrnong (Australia).

LABORATORY INVESTIGATION OF THE PERFORMANCE OF A HOLDEN ENGINE OPERATING ON LIQUIFIED PETROLEUM GAS

N. Webb Aug. 1979 49 p
(AD-A076145; EDE-28/79) Avail: NTIS HC A03/MF A01 CSCL 14/2

A laboratory investigation into the relative performances of an engine when operated on both liquified petroleum gas (LPG) and petrol showed that the engine operated at higher terminal efficiency on LPG and also that it would operate satisfactorily at leaner air-fuel mixtures on this fuel. Engine performance was less affected by retarded ignition for LPG than for petrol. Furthermore, a large increase in dwell angle from the recommended setting had no significant effect on LPG performance. The LPG carburettor when installed in its normal configuration maintained an essentially constant mixture strength with no part throttle leaning of mixtures to give better efficiency nor corresponding full throttle enrichment to give best engine torque. GRA

N80-18412# General Electric Co., Syracuse, N.Y.

ALTERNATIVE METHOD FOR THE EVALUATION OF FUSED GLASS-TO-METAL SEALS Final Technical Report, 19 Jan. 1978 - 19 Feb. 1979

G. F. Trojanowski and L. Zakraysek Griffiss AFB, N.Y. RADC May 1979 52 p refs
(Contract F30602-78-C-0086; AF Proj. 2338)
(AD-A077514; PM-13-79; RADC-TR-79-98) Avail: NTIS HC A04/MF A01 CSCL 11/1

Glass-to-metal seals on electronic component packages make it possible to obtain electrical feed-thru while maintaining hermeticity throughout severe environmental exposure. As a result of this study, it was determined that sealed sub-assemblies will generally pass the least severe thermal shock requirement of MIL-STD-883, but that the same (previously accepted) lots will exhibit a 6%, or higher, failure rate as a result of manufacturing stresses imposed by cover welding, delidding, and thermal bakes or soaks. During this study, the use of tighter controls on the more critical glass sealing processes was shown to reduce the reject rate to less than 1%. Success in matched glass-seal making depends on the use of three thermal treatments for Kovar: de-carburizing, pre-oxidation and sealing. This report deals specifically with pre-oxidation and sealing. An oxide film on Kovar, prior to sealing, promotes glass wetting and provides for the development of a chemical-mechanical bond at the glass-metal interface. A determination for residual intergranular oxide is useful for judging the quality of a matched glass-to-metal seal where pre-oxidation is a requisite for sealing. Residual oxides can be detected by metallographic techniques, and the range of 2.0 - 6.5 micrometers is appropriate for high quality glass seals. Other effects are also detectable by the evaluation of metallographic cross-sections of sealed packages. These include volume fraction of bubble formation, bubble size, bubble distribution, glass-metal separation and other interface criteria. GRA

N80-18413# National Swedish Road and Traffic Research Inst., Linkoeping.
EXPERIMENTAL USE OF ELECTRONIC DIRECTION FINDING INDICATORS IN SNOW REMOVAL
Roland Oestergren 1977 41 p In SWEDISH; ENGLISH summary
(VTI-130) Avail: NTIS HC A03/MF A01

Equipment for detecting the lateral position of snow removal vehicles was tested under realistic winter conditions. A magnetic steering cable is buried in each traffic lane of the roadway, with detectors mounted in the vehicle giving visual position indications. Drivers had difficulty following the cables because of the need to scan the instruments as well as the road directly ahead of the thrower. Author (ESA)

N80-18414# National Swedish Road and Traffic Research Inst., Linkoeping.
THE INFLUENCE OF ROAD ROUGHNESS ON THE BRAKING AND STEERING PERFORMANCE OF CARS
Georg Magnusson and Peter W. Arnberg 1977 46 p refs In SWEDISH; ENGLISH summary
(VTI-134) Avail: NTIS HC A03/MF A01

Information was compiled concerning the influence of road roughness on automobile braking and steering characteristics, and on driver performance. Evidence found indicates that road roughness has a degrading effect on wheel load and therefore steering ability, but contradictory findings exist for its effects on braking performance. Drivers' visual, auditory, and kinesthetic information acquisition as well as steering ability are influenced by vibration, but it is not clear that it is important to traffic safety. Author (ESA)

N80-18415# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FLUTTER ANALYSIS OF SMALL WINDTURBINE, DESIGNED FOR MANUFACTURE AND USE IN DEVELOPING COUNTRIES
P. C. Hensing Aug. 1978 29 p refs
(UTH-LR-272) Avail: NTIS HC A03/MF A01

The flutter behavior of a wind turborotor designed for manufacture and use in developing countries was investigated. Possible improvements are discussed. The effect of scaling is considered. Results show that the addition of small tip-masses has a curative influence on flutter sensitive rotor designs. Author (ESA)

N80-18416# Technische Hogeschool, Delft (Netherlands). Lab. of Fine Mechanics.
A STUDY OF SOME ASPECTS OF THE MECHANICAL BEHAVIOR OF CROSS-SPRING PIVOTS AND PLATE SPRING MECHANISMS WITH NEGATIVE STIFFNESS
J. F. Dijksman May 1979 121 p refs
(WTHD-116) Avail: NTIS HC A06/MF A01

Several aspects of mechanical and kinematical behavior involving a guiding composed of a cross-spring pivot are investigated. Formulas are given for determining the radial flexibility of a cross-spring pivot as a function of the angle of rotation. The mechanical properties of mechanisms composed of flat thin plate springs are also calculated. These mechanisms are suitable for reducing positive stiffness of an elastic guiding for translation. Author (ESA)

N80-18417# National Technical Information Service, Springfield, Va.
SEALS AND GASKETS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Nov. 1976 - Nov. 1979
William E. Reed Dec. 1979 125 p Supersedes NTIS/PS-78/1251; NTIS/PS-77/1093; NTIS/PS-76/0938; NTIS/PS-75/838; NTIS/PS-75/140
(PB80-802010; NTIS/PS-78/1251; NTIS/PS-77/1093; NTIS/PS-76/0938; NTIS/PS-75/838; NTIS/PS-75/140) Avail: NTIS HC $30.00/MF $30.00 CSCL 11A

Both gas and liquid seals are considered. Areas studied include polymers, physical properties, glass metal seals, configurations, test methods, and design. Applications involve such areas as gas turbines, water pumps, shaft seals, spacecraft seals, and other specialized seals and gaskets. Highway joint seals are excluded. This updated bibliography contains 213 abstracts, 74 of which are new entries to the previous edition. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-18418# Aeronautical Research Labs., Melbourne (Australia).
RELIABILITY ANALYSIS FOR OPTIMUM DESIGN
A. O. Payne and A. D. Graham 14 Sep. 1978 18 p refs Repr. from Eng. Fracture Mech., Great Britain, v. 12, 1979 p 329-346
(ICAF-1132) Avail: NTIS HC A02/MF A01

An approach is presented which offers a means of enabling the influence of significant design parameters to be studied and the design to be optimized. It is illustrated by two applications-assessment of ultimate load design procedures for an offshore drilling unit and the derivation of a reliability based inspection procedure for a crop-dusting aircraft. The approach requires extensive data not normally available in design and is still in the development stage, but it is seen as an approach to achieving an optimum design. R.E.S.

N80-18419# Arinc Research Corp., Annapolis, Md.
THE APPLICATION OF RELIABILITY IMPROVEMENT WARRANTY TO DYNAMIC SYSTEMS Final Report, 26 Sep. 1978 - 4 Sep. 1979
A. A. Bilodeau, F. B. Crum, W. A. Dunphy, and R. A. Kowalski 4 Sep. 1979 162 p
(Contract DAAK70-78-C-0200)
(AD-A075520; Rept-1736-01-1-2025; MERADCOM-TQ-1) Avail: NTIS HC A08/MF A01 CSCL 14/4

The Reliability Improvement Warranty (RIW) is currently used within the Department of Defense to provide an incentive to contractors to design and produce equipment that will have a low failure rate, as well as low costs of repair following failure in field or operational use. Current applications of RIW have generally been restricted to initial production procurements of relatively small, transportable avionics equipment. The RIW concept has potential applications for dynamic systems (e.g., transmissions, gearboxes, engines, etc.) procured by the U.S. Army Mobility Equipment Research and Development Command (MERADCOM). However, dynamic systems may differ from avionics in design and maintenance concepts, transportability features, and deployment and utilization philosophy. Therefore, current criteria for using RIW and current guidelines for developing RIW terms and conditions should be reviewed and adapted for this new class of systems. This effort identified several differences between the characteristics of dynamic systems and those of RIW avionics equipment that are not emphasized in current RIW guidelines. RIW application criteria for dynamic systems were also developed. An existing life-cycle cost (LCC) model was modified to address quantitative features of dynamic systems that should be considered in an economic analysis of RIW versus organic maintenance. Case studies were developed to demonstrate the use of the RIW selection criteria and the LCC model. GRA

N80-18420# Illinois Univ. at Urbana-Champaign. Engineering-Psychology Research Lab.
THE PROCESSING RESOURCE DEMANDS OF FAILURE DETECTION IN DYNAMIC SYSTEMS
Christopher D. Wickens and Colin Kessel Jan. 1979 27 p refs
(Grant AF-AFOSR-3380-77)
(AD-A078329; EPL-79-1/AFOSR-79-1; AFOSR-79-0684TR)
Avail: NTIS HC A03/MF A01 CSCL 05/8

A conception of human attentional resources is presented that describes these resources, not as an undifferentiated pool of capacity, but as partitioned into separate structure-specific reservoirs related to the processes of encoding, central processing and responding. An experiment is then described in which subjects detected dynamic system failures, either while actually tracking the control dynamics (manual mode), or while passively observing an autopilot controlling the dynamics (automatic mode). Failure detection, the primary task was performed alone, and with each of two structurally different loading tasks: mental arithmetic and a critical instability tracking task. Manual detection and primary task tracking were affected by the critical tracking task but not by mental arithmetic. The opposite pattern of interference was found for automatic detection. Assuming that manual and automatic detection depend upon different information sources, these results are shown to be compatible with the concept of structure-specific resources. GRA

N80-18421# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE TESTING: X-RAY PHOTOGRAPHY AND RADIOGRAPHY, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Report, Aug. 1976 - Sep. 1979
William E. Reed Dec. 1979 283 p Supersedes NTIS/PS-78/1059; NTIS/PS-77/0910; NTIS/PS-76/0781
(PB80-802200; NTIS/PS-78/1059; NTIS/PS-77/0910; NTIS/PS-76/0781) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Techniques, equipment, and applications for nondestructive testing are discussed. Applications include flaw detection, fatigue determination, inspection of joints, quality control, and measurement of mechanical and physical properties. This updated bibliography contains 277 abstracts, 94 of which are new entries to the previous edition. GRA

N80-18422# National Technical Information Service, Springfield, Va.
NONDESTRUCTIVE TESTING: X-RAY PHOTOGRAPHY AND RADIOGRAPHY. CITATIONS FROM THE NTIS DATA BASE Report, 1964 - Sep. 1979
William E. Reed Dec. 1979 286 p Supersedes NTIS/PS-78/1058; NTIS/PS-77/0908; NTIS/PS-76/0780; NTIS/PS-75/666
(PB80-802192; NTIS/PS-78/1058; NTIS/PS-77/0908; NTIS/PS-76/0780; NTIS/PS-75/666) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Techniques, equipment, and applications for nondestructive testing are discussed. Applications include flaw detection, fatigue determination, inspection of joints, and measurement of mechanical and physical properties. This updated bibliography contains 278 abstracts, 30 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N80-18423 Illinois Univ. at Urbana-Champaign.
MIXED-MODE FRACTURE ANALYSIS USING A CONSERVATION INTEGRAL Ph.D. Thesis
Jen-fu Yau 1979 116 p
Avail: Univ. Microfilms Order No. 8004309

An efficient and convenient method of analysis for determining stress intensity factors for two-dimensional mixed mode fracture problems with complicated geometry and loading conditions (static or dynamic) is presented. The method is applicable to a wide variety of material properties including linear elastic isotropic, anisotropic, as well as isotropic bimaterials and linear viscoelastic behavior. One of the salient features of the present analysis is that it can directly determine mixed mode stress intensity solutions from the conservation integral without the need of solving the corresponding complex boundary value problem. This method is demonstrated to be superior in its numerical simplicity to other approaches, since the conservation integral can be conveniently evaluated along a path removed from the crack tip region. Solutions of complicated and practical engineering problems such as cracks emanating from a circular hole and a crack branching from an edge crack in a fibrous composite are presented.
Dissert. Abstr.

N80-18424 Clemson Univ., S.C.
COLLAPSE LOAD ANALYSIS FOR PLATES AND PANELS Ph.D. Thesis
Kailasam Satyamurthy 1979 101 p
Avail: Univ. Microfilms Order No. 8003339

A FORTRAN, large capacity computer program was developed to determine collapse loads and bifurcation loads for fiber reinforced, laminated, circular cylindrical panels with rectangular plan form and rectangular plates under general loading systems and boundary conditions. The program is based on the principle of total potential energy and uses finite difference in the discretization process. Whole station spacing was used to calculate the strain energy associated with an area element and an orthogonal finite difference grid that provides for variable spacings in perpendicular directions is incorporated. Numerical results for isotropic panels are presented that compare favorably with results obtained via the general computer program STAGS. Other numerical results for fiber reinforced, laminated panels are also presented that illustrate the types of boundary conditions, applied loads, cut-outs, and initial geometric imperfections that can be handled by the present program. Dissert. Abstr.

N80-18425 Illinois Univ. at Urbana-Champaign.
BOUNDARY INTEGRAL EQUATION SOLUTION OF PLANE ELASTICITY PROBLEMS WITH HIGH STRESS CONCENTRATIONS Ph.D. Thesis
Hassan Nikooyeh 1979 133 p
Avail: Univ. Microfilms Order No. 8004240

A numerical method for determination of stresses in two-dimensional elastic bodies with high stress concentration is presented. Major emphasis is placed on bodies with a notch having a fillet of small radius and bodies with a crack of small width. These static boundary value problems are formulated in terms of boundary integral equations of a type used previously for sharp notches and cracks. The results for the fillet problem are used to develop analytical solutions for the intermediate region adjacent to the fillet region. In this way the details of the boundary configuration of the fillet are reflected in a set of generalized displacements which characterize the intermediate field. For the solution of the whole body including the loaded boundary, kernels are used to pick out the generalized displacements of the intermediate region. The solution of the wide crack problem is similar except that a perturbation scheme is required to ensure homogeneous boundary conditions at the actual edges of the crack. Dissert. Abstr.

N80-18426 Colorado Univ. at Boulder.
RESPONSE OF A CIRCULAR CYLINDRICAL SHELL TO DISTURBANCES IN A HALF-SPACE Ph.D. Thesis
Nabil Mohamed El-Akily 1979 206 p
Avail: Univ. Microfilms Order No. 8002971

The problem of determining the steady state dynamic response of a circular cylindrical shell to disturbances in a half-space is discussed. Both the shell and the surrounding medium are assumed to be linearly elastic, isotropic, and homogeneous and the shell is assumed to be in welded contact with the surrounding medium. Approximate solutions for the response of the shell and as a limiting case of the shell, the solutions for the cavity are presented. The solutions in both cases are obtained by two different methods. First, the method of matched asymptotic expansions

is used. The second method of solution (the method of successive reflections) is based on assuming two infinite series representing the scattered field. The usefulness and the range of applicability of each method is established for the cases studied.
Dissert. Abstr.

N80-18427*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STRESS ANALYSIS AND BUCKLING OF J-STIFFENED GRAPHITE-EPOXY PANEL

Randall C. Davis Washington Feb. 1980 23 p refs
(NASA-TP-1607; L-13256) Avail: NTIS HC A02/MF A01 CSCL 20K

A graphite epoxy shear panel with bonded on J stiffeners was investigated. The panel, loaded to buckling in a picture frame shear test is described. Two finite element models, each of which included the doubler material bonded to the panel skin under the stiffeners and at the panel edges, were used to make a stress analysis of the panel. The shear load distributions in the panel from two commonly used boundary conditions, applied shear load and applied displacement, were compared with the results from one of the finite element models that included the picture frame test fixture. A.W.H.

N80-18428*# Lehigh Univ., Bethlehem, Pa.

STRESS INTENSITY FACTORS IN TWO BONDED ELASTIC LAYERS CONTAINING CRACKS PERPENDICULAR TO AND ON THE INTERFACE. PART 1: ANALYSIS

Ming-Che Lu and F. Erdogan Jan. 1980 31 p refs 2 Vol.
(Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159218) Avail: NTIS HC A03/MF A01 CSCL 20K

The basic crack problem which is essential for the study of subcritical crack propagation and fracture of layered structural materials is considered. Because of the apparent analytical difficulties, the problem is idealized as one of plane strain or plane stress. An additional simplifying assumption is made by restricting the formulation of the problem to crack geometries and loading conditions which have a plane of symmetry perpendicular to the interface. The general problem is formulated in terms of a coupled system of four integral equations. For each relevant crack configuration of practical interest, the singular behavior of the solution near and at the ends and points of intersection of the cracks is investigated and the related characteristic equations are obtained. The edge crack terminating at and crossing the interface, the T-shaped crack consisting of a broken layer and a delamination crack, the cross-shaped crack which consists of a delamination crack intersecting a crack which is perpendicular to the interface, and a delamination crack initiating from a stress-free boundary of the bonded layers are some of the practical crack geometries considered. A.R.H.

N80-18429*# Lehigh Univ., Bethlehem, Pa.

STRESS INTENSITY FACTORS IN TWO BONDED ELASTIC LAYERS CONTAINING CRACKS PERPENDICULAR TO AND ON THE INTERFACE. PART 2: SOLUTION AND RESULTS

Ming-Che Lu and F. Erdogan Jan. 1980 53 p refs 2 Vol.
(Grants NGR-39-007-011; NSF ENG-78-09737)
(NASA-CR-159219) Avail: NTIS HC A04/MF A01 CSCL 20K

The numerical method is given for solving the plane problem for two, bonded infinite dissimilar elastic strips which contain cracks of various configurations. The problem is intended to approximate a composite beam or a plate having cracks perpendicular to and on the interface of the two layers. A.R.H.

N80-18430# Tokyo Univ. (Japan).

FRACTURE MECHANICS IN JAPAN

Takeo Yokobori 1978 20 p refs Repr. from Fracture Mech., Proc. Intern. Symp. on Fracture Mech., 1978 p 91-109 Presented at Intern. Symp. on Fracture Mech., Washington, D.C., 1978
(ICAF-1123) Avail: NTIS HC A02/MF A01

A brief survey of fracture mechanics studies in Japan is given. Combined micro and macrofracture mechanics including both crack and crystal dislocation as stress concentrators, rate process theory and nucleation theory of fracture, including both thermal fluctuation and macroscopic stress concentration such as crack are among the topics examined. Comparative fracture studies, on cracked specimens and uncracked specimens, on brittle fracture and fatigue, crack arrest for fracture design, and high temperature strength and fracture are included. J.M.S.

N80-18431# Kawasaki Heavy Industries, Ltd., Akashi (Japan). Technical Inst.

STUDY ON CRACK PROPAGATION UNDER QUASI-RANDOM LOADING

Toshiyasu Tsunenari and Hideo Ono 1978 14 p refs
(Doc-XIII-876-78; ICAF-1124) Avail: NTIS HC A02/MF A01

A crack propagation model incorporating retardation effects is proposed in order to more precisely determine crack propagation in hulls under random wave loads. Simulation results show good agreement with results of crack propagation tests under quasi-random loads. K.L.

N80-18432# Osaka Univ. (Japan).

ESTIMATION OF THE FATIGUE STRENGTH OF WELDED JOINTS BASED ON NON-DESTRUCTIVE TEST RESULTS

Kunihiko Satoh and Kenji Seo Mar. 1979 17 p refs Repr. from Proc. 1st Conf. on N.D.T., R.O.C. (Japan), Mar. 1979 17p
(ICAF-1125) Avail: NTIS HC A02/MF A01

The relationship between the fatigue strength of welded joints and the results of nondestructive test was investigated experimentally. Furthermore, statistical data of stress concentration factor caused by porosities were obtained by finite element method. It was found that the fatigue strength of welded joints with porosites could be estimated theoretically by using these statistical data and the fatigue strength reduction factor. Author

N80-18433# Kyoto Univ. (Japan). Dept. of Engineering Science.

LOCAL RESIDUAL STRESS NEAR FATIGUE CRACK TIP

Shuji Taira and Keisuke Tanaka 1978 9 p refs Repr. from Trans. Iron Steel Inst. Jap. (Japan), v. 19, 1979 p 411-418
(ICAF-1129) Avail: NTIS HC A02/MF A01

The distribution of residual stress near the tip of a fatigue crack propagating under constant amplitude stress cycling accompanied by several cycles of overloads was measured using an X-ray microbeam diffraction technique. The residual stress measured in the close vicinity of the crack tip was compressive and gradually changed to tensile at a certain distance from the crack tip. The compressive residual stress became higher as the number of overload cycles increased. The high compressive residual stress may be responsible for a large amount of growth retardation of a fatigue crack due to increasing numbers of overload cycles. A theoretical method to predict the growth rate of a fatigue crack from information on the local residual distribution near the tips of fatigue cracks is presented. K.L.

N80-18434# Kyoto Univ. (Japan).

STATISTICAL EVALUATION OF FATIGUE LIVES AT AND NEAR FATIGUE LIMIT FOR NOTCHED SPECIMENS OF STEEL AND THEIR LIFE DISTRIBUTIONS

Toshiro Yamada, Susumu Sogami, and Daisuke Kawamura 1979 7 p refs Repr. from Proc. of the 22nd Japan Congr. on Mater. Res. (Japan), 1979 p 169-174
(ICAF-1131) Avail: NTIS HC A02/MF A01

The initiation and the propagation of the fatigue cracks as well as the shape of distribution of cracks near the fatigue limit are studied for a CR-MO steel. Fatigue cracks are observed using an electronmagnescope. The relations between the distribution of fatigue lives and the propagation and distribution of fatigue cracks are investigated. A statistical distribution function lives at and near the fatigue limit is proposed. J.M.S.

N80-18435# French Air Force, Vanves (France).

ACTION OF PLASTIC DEFORMATIONS IN THE MECHANICAL DAMAGE SUFFERED BY THE SURFACE OF STRUCTURES

William Barrois 1979 19 p refs In FRENCH; ENGLISH summary
(ICAF-1114) Avail: NTIS HC A02/MF A01

After reviewing the essential features of the fatigue behavior of metal structures in service, it is shown that the elementary phenomena of plastic deformation and fatigue crack propagation, which explain the fatigue behavior of notched parts, also play an important role in other modes of damage of machinery parts. This is the case for mechanical surface damage under repeated bearing pressure in the absence of any apparent lateral sliding, for fretting fatigue in which there is alternating lateral displacements of very low amplitude, and for false-brinelling marks in ball or roller bearings. It is also the case for unidirectional friction wear and for rolling damage, either with friction in gears or with very low friction in ball or roller bearings. R.E.S.

N80-18436# French Air Force, Vanves (France).

REPEATED PLASTIC DEFORMATION AS A CAUSE OF MECHANICAL SURFACE DAMAGE IN FATIGUE, WEAR, FRETTING-FATIGUE, AND ROLLING FATIGUE: A REVIEW

William Barrois 1979 24 p refs

(ICAF-1116) Copyright. Avail: NTIS HC A02/MF A01

Statements bringing together essential features of the fatigue behavior of metal structures in service are reviewed. It is shown that the elementary phenomena of plastic deformation and fatigue crack propagation, which explain the fatigue behaviour of notched parts, also play an important role in other modes of damage of machinery parts. This is the case for mechanical surface damage under repeated bearing pressures in the absence of any apparent lateral sliding, for fretting-fatigue in which there alternating lateral displacement of very low amplitude, and for false-brinelling marks in ball or roller bearings. It is also the case for unidirectional friction wear and for rolling damage, either with friction in gears or with very low friction in ball or roller bearings. R.E.S.

N80-18437# Doshisha Univ., Kyoto (Japan).

A RELIABILITY ANALYSIS APPROACH TO FATIGUE LIFE DISPERSION OF LAMINATED GLASS FIBER COMPOSITE MATERIALS

T. Tanimoto, S. Amijima, H. Ishikawa (Kagawa Univ., Japan), K. J. Miller, ed. (Sheffield Univ., England), and R. F. Smith, ed. (Welding Inst., Cambridge, England) Oxford, England Pergamon Press 1979 11 p refs Repr. from ICM, England Presented at the 3d Intern. Conf. on Mech. Behavior of Mater. Cambridge, England, 20-24 Aug. 1979

(ICAF-1127) Avail: NTIS HC A02/MF A01

The statistical nature of the fatigue life of laminated glass fiber composite materials (FRP) is studied. Four different FRP laminates (satin woven FRP, plain woven FRP, roving woven FRP, and SMC laminated FRP) were used in the experiments. Unidirectional carbon fiber reinforced plastic was used for comparison. P-S-N diagrams for each laminate are presented. A statistical approach based on the Weibull distribution was applied to the test data to evaluate the dispersion in the fatigue life of the material. The effect of varying applied stress levels, specimen size, and glass fiber content on the fatigue life and its dispersion of the laminates is discussed. A.W.H.

N80-18438# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

MINITWIST: A SHORTENED VERSION OF TWIST

H. Lowak, J. B. DeJonge, J. Franz, and D. Schuetz 1979 25 p refs In GREEK

(LBF-TB-146) Avail: NTIS HC A02/MF A01

A description of the shortened version of the transport wing standard load program (TWIST), called MINITWIST, is presented. In all cases where testing time is a prohibitive factor to use TWIST, it is proposed to use this shortened program. The user of this shortened program should be aware though that in most cases the load cycles with high frequency and low amplitude omitted in MINITWIST would contribute to damage; thus the results will overestimate the fatigue life. R.E.S.

N80-18439# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

LITERATURE REVIEW ON THE MECHANICAL BEHAVIOR OF FIBER COMPOSITE MATERIALS. ANALYSIS OF THE STATE-OF-THE-ART, VOLUME 1 [SCHRIFTTUMSRECHERCHE ZUM FESTIGKEITSVERHALTEN VON FASERVERBUNDWERKSTOFFEN ANALYSE DES STANDES DER TECHNIK - BAND 1]

J. J. Gerharz and D. Schuetz 1979 436 p refs In GERMAN

(LBF-TB-145-Vol-1) Avail: NTIS HC A19/MF A01

Literature concerning the mechanical behavior of fiber reinforced plastic materials is surveyed. The topics evaluated include results of damage observations, mechanisms and influences of moisture absorption, and inspection and testing methods. Calculation procedures and models for the prediction of the mechanical behavior of composites are also analyzed. Examples of structural applications are presented and development efforts in fiber composite technology are indicated. K.L.

N80-18440# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

LITERATURE REVIEW ON THE MECHANICAL BEHAVIOR OF FIBER COMPOSITE MATERIALS. ANALYSIS OF THE STATE-OF-THE-ART. VOLUME 2: APPENDIX [SCHRIFTTUMSRECHERCHE ZUM FESTIGKEITSVERHALTEN VON FASTERVERBUNDWERKSTOFFEN ANALYSE DES STANDES DER TECHNIK - BAND 2: ANHANG]

J. J. Gerharz 1979 519 p refs In GERMAN

(LBF-TB-145-Vol-2-App) Avail: NTIS HC A22/MF A01

The literature concerning the mechanical behavior of fiber reinforced plastic materials is catalogued by essential test parameters. The results of damage observations, the mechanism and influence of moisture absorption, and inspection and testing methods are included along with calculation procedures and models for predicting mechanical behavior. Structural applications and development efforts in fiber composite technology are indicated. K.L.

N80-18441# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

FATIGUE BEHAVIOUR OF HIGH-PRESSURE VESSELS [FESTIGKEIT VON HOCHDRUCKBEHAELTERN FUER NEUARTIGE FERTIGUNGSVERFAHREN]

V. Grubisic and C. M. Sonsino 1979 250 p refs In GERMAN

(LBF-FB-148) Avail: NTIS HC A11/MF A01

Fatigue experiments on plain and cylindrical specimens with high strain concentration prove that low cycle material properties determined on unnotched specimens can be applied for the dimensioning of these vessels to a defined initial crack. Dimensioning including the stage of crack-propagation is not recommended because of very high strain-intensities and resulting small critical crack-depths, as several damage cases show. R.E.S.

N80-18442# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

FATIGUE BEHAVIOR OF NODULAR IRON UNDER COMBINED STATIC AND DYNAMIC MULTIAXIAL STRESSES [FESTIGKEITSVERHALTEN VON SPHAEROGUB BEI KOMBINIERTER STATISCHER UND DYNAMISHCER MEHRACHSIGER BEANSPRUCHUNG]

V. Grubisic and J. Neugebauer 1979 59 p refs In GERMAN

(LBF-FB-149) Avail: NTIS HC A04/MF A01

Specimens of GGG 60 were tested under combined axial load and torsion acting in phase and out of phase. Under combined out of phase stresses, an increase in fatigue life that was dependent on the mean stresses occurred. A computer program used to determine the magnitude and direction of the equivalent stress is described. K.L.

N80-18443# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

FATIGUE MEASURING GAUGES (FMG): A NEW SYSTEM FOR MONITORING FATIGUE LOADS

W. Ludwig, K. F. Sahm, and E. Steinheil 1979 23 p Presented at Tenth ICAF Symp., 17 May 1979, Brussels

Avail: NTIS HC A02/MF A01

An optical fatigue measuring gage (FMG), which provides monitoring of ingegral fatigue loads of individual structural units up to any given state in operational life, is described and evaluated. It is based on specially prepared, polished, and annealed metal foils which are cemented to the sites of structural units to be controlled, and which have the property of storing dynamic loads via well defined changes in surface properties due to plastic deformation. The measuring apparatus is made up of an optical measuring head and a display unit. The measuring head contains an illumination system with lenses producing a parallel beam as well as electron optical receivers. The FMG reveal information on load history of structural units for the time the foils have been attached. The various possibilities for monitoring fatigue loads are described and FMG data are correlated with fatigue failure data of materials and structural units. M.G.

N80-18444# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
SEPARATION OF PRESTRESSED-TIME FUNCTIONS AFTER THEIR BEGINNING [TRENNUNG VON BEANSPRUCHUNGS-ZEITTUNKTIONEN NACH IHREM UPSPRUNG]
O. Buxbaum and J. M. Zaschel 1979 8 p refs Repr. from Sonderdruck aus Konstrwktion, West Germany, v. 31, no. 9, 1979 p 345-351 In GERMAN
Avail: NTIS HC A02/MF A01

Random stress-time histories as measured at structures in service consist usually of two parts, i.e., stresses caused by environment and by the so-called working process inherent in the usage of the structure. In order to obtain a reliable fatigue life assessment, these two parts must be separated before analysis is performed. Criteria are defined which can be used to identify either of the two parts. Based upon these criteria, methods for a separation were developed. It was demonstrated on a number of examples that for a wide range of stress-time histories two methods can be applied, i.e., frequency filtering and a separation of single stress variations characterized by shape and period. R.E.S.

N80-18445*# National Aeronautics and Space Administration, Washington, D. C.
A CONTRIBUTION TO NONLINEAR ROD THEORY
D. Petersen Nov. 1979 7 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (West Germany), v. 59, May 1979 p T205 - T206 Original language document was announced as A79-43975 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75734) Avail: NTIS HC A02/MF A01 CSCL 20K

The application of rod theories of higher order for the analysis of rotor blades is considered. It is demonstrated that the introduction of higher order terms must be consonant with the hypotheses of the rod theory, and linear theory premises cannot be used heedless of the consequences. M.G.

N80-18446*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AEROELASTIC EQUATIONS OF MOTION OF A DARRIEUS VERTICAL-AXIS WIND-TURBINE BLADE
Krishna Rao V. Kaza (Toledo Univ.) and Raymond G. Kvaternik Dec. 1979 57 p refs
(Contract E(49-26)-1028)
(NASA-TM-79295; DOE/NASA/1028-79/25; E-238) Avail: NTIS HC A04/MF A01 CSCL 20K

The second-degree nonlinear aeroelastic equations of motion for a slender, flexible, nonuniform, Darrieus vertical-axis wind turbine blade which is undergoing combined flatwise bending, edgewise bending, torsion, and extension are developed using Hamilton's principle. The blade aerodynamic loading is obtained from strip theory based on a quasi-steady approximation of two-dimensional incompressible unsteady airfoil theory. The derivation of the equations has its basis in the geometric nonlinear theory of elasticity and the resulting equations are consistent with the small deformation approximation in which the elongations and shears are negligible compared to unity. These equations are suitable for studying vibrations, static and dynamic aeroelastic instabilities, and dynamic response. Several possible methods of solution of the equations, which have periodic coefficients, are discussed. K.L.

N80-18447# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
DYNAMIC STABILITY OF COLUMNS SUBJECTED TO NONCONSERVATIVE FORCES
J. J. Wu and J. D. Vasilakis Oct. 1979 23 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A078920; AD-E440053; ARLCB-TR-79030) Avail: NTIS HC A02/MF A01 CSCL 12/1

The numerical results of a class of problems of linear elastic stability problems subjected to nonconservative forces and under various support conditions are presented. A single solution formulation by which these results have been obtained is described. Accuracy of these results compared with those reported in the literature is discussed. GRA

N80-18448# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ANTI-PLANE SHEAR FIELDS WITH DISCONTINUOUS DEFORMATION GRADIENTS NEAR THE TIP OF A CRACK IN FINITE ELASTOSTATICS
J. K. Knowles and Eli Sternberg Sep. 1979 73 p refs
(Contract N00014-75-C-0196)
(AD-A076027) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper reconsiders the problem of determining the elastostatic field near the tip of a crack in an all-around infinite body deformed by a 'Mode 3' loading at infinity to a state of anti-plane shear. The problem is treated for a class of incompressible, homogeneous, isotropic elastic materials whose constitutive laws permit a loss of ellipticity in the governing displacement equation of equilibrium at sufficiently severe shearing strains. The analysis represents a generalization of that reported in an earlier study and, as before, is carried out for the 'small-scale nonlinear crack problem', in which a crack of finite length is replaced by a semi-infinite one, and the nonlinear field far from the crack-tip is matched to the near field predicted by the linearized theory. The methods employed in the present paper are necessarily largely qualitative, since they apply to all materials in the class considered. The principal feature of the resulting elastic field is the presence of two symmetrically located curves issuing from the crack-tip and bearing discontinuities in displacement gradient and stress. GRA

N80-18449# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE DURING THE PERIOD APRIL 1977 TO MARCH 1979
G. S. Jost Apr. 1979 68 p refs
(AD-A071641; ARL/Struc-TM-303) Avail: NTIS HC A04/MF A01 CSCL 01/3

A summary is presented of the aircraft fatigue research and associated activities which form part of the programs of the Aeronautical Research Laboratories, Commonwealth Aircraft Corporation Pty. Ltd., Department of Transport (Airworthiness Branch), Royal Australian Air Force and the Government Aircraft Factories. The major topics discussed include the fatigue of both civil and military aircraft structures, fatigue of materials and components and fatigue life monitoring and assessment. GRA

N80-18450# Army Research and Technology Labs., Fort Eustis, Va.
HLH ROTOR BOX BEAM FATIQUE TEST
M. Hanson Sep. 1979 21 p refs
(DA Proj. 1L1-62209-AH-76)
(AD-A076931; USARTL-TN-35) Avail: NTIS HC A02/MF A01 CSCL 20/11

The purpose of this program was to evaluate the fatigue properties of a fiberglass/epoxy box beam specimen which was similar in design to the Heavy Lift Helicopters (HLH) rotor blade spar. The fiberglass/epoxy box beam was designed and fabricated by Boeing Vertol using a ply layup scheme similar to the rotor HLH blade spar but with a different preimpregnated fiberglass tape. The box beam was tested at a fatigue load level sufficient to cause failure within a reasonable number of fatigue cycles (5 x 1000,000) to determine fatigue strength and observe failure modes and rates. Premature fatigue failure occurred in the box beam as the result of chordwise wrinkles occurring during fabrication. The Integral Spar Inspection System (ISIS), which depends on a pressure differential between the sealed spar and outside ambient pressure to detect leaks resulting from cracks or flaws, indicated that a leakage had occurred at approximately the same time the failure was observed. It was concluded that the ISIS appeared to be a viable technique for signaling a structural failure of fiberglass spars. The presence of the wrinkles in the spar which resulted in premature failure, however, precluded any conclusions with regard to the fatigue strength of the preimpregnated fiberglass tape used. GRA

N80-18451# Army Natick Research and Development Command, Mass.
FINITE ELEMENT ANALYSIS OF A STATICALLY LOADED ISO TACTICAL SHELTER
Arthur R. Johnson and Vitty P. Ciras Jan. 1979 156 p refs
(DA Proj. 1L1-62723-A-427)
(AD-A075807; NATICK/TR-79/023) Avail: NTIS HC A08/MF A01 CSCL 13/3

A finite element analysis of a 2.4 m x 2.4 m x 6.1 m (8 ft x 8 ft x 20 ft) 3-for-1 expandable Army Shelter has been made for static loads designated in the specifications for Army ISO (International Standard Organization) Tactical Shelters. The report includes a description of the load paths, an investigation of the load-carrying capability of the structure both with and without wall panels as structural members, recommendations for improving the design for static load response, a buckling analysis for the ISO stacking test, and a comparison of calculated and measured data for a series of tests performed on the prototype shelter analyzed in this report. GRA

N80-18452# Naval Research Lab., Washington, D. C. Metals Performance Branch.
PROCEDURES FOR PRECISION MEASUREMENT OF FATIGUE-CRACK-GROWTH-RATE USING CRACK-OPENING-DISPLACEMENT TECHNIQUES Final Report
G. R. Yoder, L. A. Cooley, and T. W. Crooker 19 Nov. 1979 25 p refs
(SF54591506)
(AD-A077670; NRL-MR-4120) Avail: NTIS HC A02/MF A01 CSCL 20/11

This paper describes experimental and analytical procedures whereby the conventional commercial fracture mechanics clip-gage can be used for precision measurement of fatigue-crack-growth-rate in compact tension specimens. Potential sources of error in measuring crack length via COD techniques are delineated. Comparisons are made among crack length data obtained via specimen surface observations and crack-opening-displacement (COD) techniques. Comparisons are also made among data analyzed by the secant and 7-point incremental polynomial methods. It is emphasized that COD techniques can enhance the accuracy of the secant method of data reduction. Step-loading procedures using COD techniques are described. Proposed amendments to ASTM E647-78T regarding incrementing of crack-length measurements via COD techniques are discussed. GRA

N80-18453# Pittsburgh Univ., Pa. School of Engineering.
SCIENCE OF FRACTURE Annual Report, 15 Aug. 1978 - 14 Aug. 1979
Max L. Williams, Jr. and Campbell C. Yates 12 Oct. 1979 126 p refs
(Contract F49620-78-C-0101; AF Proj. 2307)
(AD-A077564; SETEC-SF-79-51; AFOSR-79-1145TR) Avail: NTIS HC A07/MF A01 CSCL 20/11

This research program is intended to explore and develop commonalities in fracture theory as applied to wide classes of differing materials at different scales - from the atomic to the continuum. Primary attention is focused upon analytical and experimental methods needed to analyze underlying and potentially common basic mechanisms controlling the fracture process, e.g., two and three dimensional stress singularities, effect of environment, etc. and to examine structure-property relationships, including the effect of the fabrication process upon the preparation of specimens made from standardized model materials representative of polymers and metals. Secondary emphasis is focused upon numerical analysis methods needed at various scale levels, atomic to continuum, and instrumentation capability peculiarly suited to or needed for fracture studies. In later stages of the program, increasing attention will be devoted to technology transfer and engineering applications of the basic research. Major results during the first year include: (1) the development of a test for measuring Mode 2 fracture toughness, and (2) quantifying the effect of geometry in an embedded fiber or rod and the location of initial interfacial debonding from the matrix upon resulting adhesive fracture under load. GRA

N80-18454# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.
A STRESS-STRAIN-TIME MODEL (SST) FOR HIGH-TEMPERATURE, LOW-CYCLE FATIGUE Technical Report, Jan. 1978 - Aug. 1979
Henry L. Bernstein Aug. 1979 32 p refs
(Contract F33615-76-S-5191; AF Proj. 7351)
(AD-A078829; SRL-6909-01; AFML-TR-79-4114) Avail: NTIS HC A03/MF A01 CSCL 20/11

A Stress-Strain-Time Model (SST) has been developed to predict high-temperature, low-cycle fatigue life. The model states that the life can be predicted by three variables--stress, strain, and time. These three variables are combined in a power-law equation to predict the life. The stress parameter accounts for mean stress effects. The strain parameter accounts for time-independent fatigue damage, and the time parameter accounts for the time dependence of fatigue life. High-temperature, low-cycle fatigue data for several alloy systems are correlated to within a factor of 2.1, and data are predicted to within a factor of 2.6 using the SST Model. GRA

N80-18455# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.
A NUMERICAL APPROACH TO ELASTIC-PLASTIC PLAIN-STRAIN PROBLEMS OF THICK-WALLED CYLINDERS
P. C. T. Chen Oct. 1979 22 p refs Proposed for Presentation at the 10th Southeastern Conf. on Theoret. and Appl. Mech., Knoxville, Tenn., 17-18 Apr. 1980
(DA Proj. 1L1-61101-A-91A)
(AD-A078365; ARLCB-TR-79026) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new finite-difference approach has been developed for solving the elastic-plastic plane-strain problems of thick-walled cylinders subjected to internal or external pressure. The material is assumed to obey the von Mises' yield criterion, the Prandtl-Reuss flow theory and the isotropic hardening rule. The numerical scheme is stable for ideally-plastic as well as straining-hardening materials. The approach is simpler than others, and very accurate solutions can be obtained by reducing the grid sizes and load increments. The results for the stresses and strains in all principal directions have been computed as functions of loading history. GRA

N80-18456# Forest Products Lab., Madison, Wis.
BENDING STRENGTH OF VERTICALLY GLUED LAMINATED BEAMS WITH ONE TO FIVE PLIES
Ronald W. Wolfe and Russell C. Moody 1979 23 p refs
Prepared in cooperation with Wisconsin Univ., Madison
(AD-A077173; FSRP-FPL-333) Avail: NTIS HC A02/MF A01 CSCL 11/12

Properties of vertically laminated beams were studied to determine the effects of number and quality of component laminations on structural performance. Deterministic and probabilistic analyses were both used to show how performance varies with number and quality of laminations and with assumed loading parameters. Increase in allowable stress with number of laminations, currently recognized as a constant adjustment for three or more laminations, was significant for two-lamination beams as well. This increase proved to be inversely related to lumber quality. Results will be helpful to organizations publishing engineering design stresses in establishing a more efficient design of vertically laminated beams. GRA

N80-18457# Royal Inst. of Tech., Stockholm (Sweden). Inst.
BENDING PROPERTIES OF NON-HOMOGENEOUS PLATES OF ISOTROPIC AND ORTHOTROPIC MATERIALS [BOEJSTYVHET HOS EN ICKE-HOMOGEN PLATTA AV ISOTROPT OCH ORTOTROPT MATERIAL]
Pavel Sindelar 1977 24 p refs In SWEDISH
(TRITA-HFL-21) Avail: NTIS HC A02/MF A01

The bending properties of laminated plates composed of several layers of different homogeneous materials was studied. Isotropic and orthotropic materials were considered. A bending theory for thin, uniform, and flat plate was developed. The corresponding equations are presented together with numerical examples. It is shown that while the orthotropy and the width ratio have a noticeable influence on the bending characteristics, the shearing force ratio is of minor importance. Author (ESA)

N80-18458# Royal Inst. of Tech., Stockholm (Sweden).
FRACTURE MECHANICS STUDY OF FRESH WATER ICE [BROTTMEKANISKA STUDIER AV FAERSKVATTENIS]
Holger Droege Dec. 1975 70 p refs In SWEDISH
(TRITA-HFL-0021; Publ-201) Avail: NTIS HC A04/MF A01

Various experiments done on fresh water ice are reported. Some general physical characteristics and data linked to elasticity research are described. The results of fracture elasticity experiments on artificial fresh water ice at -10 C are given. A special hydraulic press was used and displacement, force, and time were registered by two X-Y recorders. Polarized light photographs were taken. Load rates of 100 14, and 1.3 N/s were used. Only for the 100 and 14 N/s was fracture elasticity found in accordance with linear fracture mechanics prediction. The average value of fracture elasticity was 0.16 and 0.26 mega newton per meter to the 3/2 power respectively. The corresponding values for the re-iced test samples are 0.13 and 0.19 MN/m to the 3/2 power respectively. Author (ESA)

N80-18459# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
FATIGUE CRACK GROWTH IN LUGS AND THE STRESS INTENSITY FACTOR
J. Schijve and A. H. W. Hoeymakers Jul. 1978 28 p refs
(VTH-LR-273) Avail: NTIS HC A03/MF A01

Crack growth in aluminium alloy lugs was recorded during constant amplitude loading (R = 1/3). Observations were made both for artificial cracks started by a small saw cut and natural cracks started by fretting corrosion between hole and pin. Scatter was low for artificial cracks, whereas considerable scatter was seen at the natural cracks as a result of multiple crack initiation at different times and locations. The fastest crack growth was observed for artificial cracks which appear to be a worst case as compared to natural cracks. The K-values derived from crack growth results were in good agreement with K-values reported in the literature. Author (ESA)

N80-18460# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
UTILIZATION OF 'STAGS' TO DETERMINE KNOCKDOWN FACTORS FROM MEASURED INITIAL IMPERFECTIONS
Johann Arbocz and C. D. Babcock Nov. 1978 88 p refs
(VTH-LR-275) Avail: NTIS HC A05/MF A01

Various methods for predicting the buckling load of axially compressed stringer stiffened shells in the presence of initial imperfections were evaluated. Both simplified analytical methods and refined computer codes based on finite difference energy formulation (STAGS) were used. The analytical predictions were validated by comparison with the experimentally determined buckling load. A method is proposed which makes it possible to take into account both the effect of initial imperfections and the effect of the appropriate boundary conditions. Author (ESA)

N80-18461# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A MODEL OF AN ELASTIC EARTH BY A FINITE ELEMENT METHOD APPLIED TO SPHERICAL SHELLS Thesis - Tech. Univ., Berlin [MODELL EINER ELASTISCHEN ERDE AUF DER GRUNDLAGE FINITER KUGELSCHALEN-ELEMENTE]
Heinz-Juergen Szameitat 1979 133 p refs In GERMAN
(Ser-C/Diss-249-Mitt-149) Avail: NTIS HC A07/MF A01

In the model, the Earth is represented by a series of concentric spheres of constant density, each of which is given an analytical function. A computer program analyzes the elastic deformation and produces potentials and variations in the gravity field. Author (ESA)

N80-18214 Pacific Missile Test Center, Point Mugu, Calif.
A MATHEMATICAL METHOD FOR DETERMINING A LABORATORY SIMULATION OF THE CAPTIVE-FLIGHT VIBRATIONAL ENVIRONMENT
Sharon Ogden *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 1-4 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18215 Pacific Missile Test Center, Point Mugu, Calif.
ACOUSTICS OR SHAKERS FOR SIMULATION OF CAPTIVE FLIGHT VIBRATION
A. M. Spandrio and M. E. Burke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 5-14 (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18220 Sandia Labs., Albuquerque, N. Mex. Applied Mechanics Div.
CONSERVATISM IN RANDOM VIBRATION ANALYSIS AND TESTING
Thomas L. Paez *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 57-70 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18223 Monash Univ., Clayton (Australia).
HIGH FREQUENCY GROUND VIBRATION MEASUREMENT
H. Nolle *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 95-103 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

N80-18224 Bouche Labs., Sun Valley, Calif.
THE RECIPROCITY CALIBRATION OF VIBRATION STANDARDS OVER AN EXTENDED FREQUENCY RANGE
R. R. Bouche *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., Pt. 4 Sep. 1978 p 105-111 refs (For primary document see N80-18213 09-31)
Avail: NRL, Tech. Inform. Div., Washington, D.C.

42 GEOSCIENCES (GENERAL)

N80-18462*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
SOLAR-TERRESTRIAL PREDICTIONS PROCEEDINGS. VOLUME 1: PREDICTION GROUP REPORTS
Richard F. Donnelly, ed. Aug. 1979 433 p refs Workshop held in Boulder, Colo., 23-27 Apr. 1979 Sponsored by NASA, AFGL, AFOSR, DOE and NSF
(NASA-CR-162794) Avail: NTIS MF A01; SOD HC CSCL 04A

The current practice in solar terrestrial predictions is reviewed with emphasis of prediction, warning, and monitoring services. Topics covered include: ionosphere-reflected HF radio propagation; radiation hazards for manned space flights and high altitude and high latitude aircraft flights; and geomagnetic activity. For individual titles, see N80-18463 through N80-18495.

N80-18463*# Observatoire de Meudon (France).
THE FORECASTING CENTER OF MEUDON, FRANCE c47
Paul Simon *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 1-11 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04B

Main features of solar activity are described in relation to solar and geophysical forecasting. Spectroheliograms, radio and X-ray data, white light coronal observations, particles data, photospheric images, and photospheric magnetic fields are among the types of data used to identify the active centers and flares of the Sun. Forecasting and identification of geomagnetic activity is also discussed. The forecasting technique is described along with the types of users. J.M.S.

N80-18464*# Centre National d'Etudes des Telecommunications, Lannion (France). Dept. Mesures Ionospheriques et Radioelectriques.
THE FRENCH SHORT TERM RADIOPROPAGATION PREDICTIONS IN THE DECAMETER BAND c32
P. Lassudrie-Duchesne, A. M. Bourdila, and H. Sizun *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 12-24 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

Weekly and daily predictions of the ionospheric characteristics relevant to radio propagation are considered. A description of the techniques involved is given as well as examples showing how the prediction messages are prepared. The short term predictions are confined to restricted geographical areas and are relevant to radio circuits whose terminators are both located inside the same zone. They can be used with a reasonable approximation for circuits less than 3000 km of length whose reflection point lies within a given zone. J.M.S.

N80-18465*# Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).

PROPAGATION PREDICTIONS FOR THE HF-RANGE BY THE RESEARCH INSTITUTE OF THE DEUTSCHE BUNDESPOST c32

Th. Damboldt *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 25-43 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 20N

Long term and short term HF propagation prediction service is described. The long term prediction method is computer based. The short term prediction method is still a manual method which relies mainly on a number of continuous field strength recordings and on the forecaster's ability to interpret the recordings and to combine this information with all available solar-geophysical data. Examples of the predictions are given and are compared with actually observed HF propagation conditions. J.M.S.

N80-18466*# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.

A METHOD OF PREDICTIONS GEOMAGNETIC ACTIVITY BASED ON A CORONAL MODEL OF RELATIONS BETWEEN SOLAR AND GEOMAGNETIC ACTIVITIES c46

Jaroslav Halenka *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 44-60 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 04A

A method developed to predict both disturbed and quiet geomagnetic periods is described. The method uses solar situations along the CM with the key role of filaments, giving indirect evidence of types of directly unobservable coronal structures above them. The time lag, not to be interpreted in terms of propagation speed, between the CM activity and the commencement of the geomagnetic response is about one to two days. Solar phenomena serve as indicators within approximately 10 deg of the CM and up to the zone of high latitude filaments. J.M.S.

N80-18467*# Polish Academy of Sciences, Warsaw. Space Research Centre.

KAZIA: A COMPUTER SYSTEM FOR SOLAR-TERRESTRIAL DATA PROCESSING AND OBJECTIVE PREDICTION c46

K. Stasiewicz, M. Maksymienko, and M. Jakimiec (Wroclaw Univ.) *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 61-66 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 04A

A computer system for solar terrestrial data processing is described. The data base consists mainly of information contained in Ursigrams exchanged between the IUWDS Regional Warning Centers. The system structure and its functions are presented. Solar flare forecasting is described, as one of the prediction techniques incorporated in the system. J.M.S.

N80-18468*# Polish Academy of Sciences, Warsaw. Space Research Centre.

ESTIMATION OF SOLAR FLAME INFLUENCE ON RADIO CIRCUIT TRANSMISSION LOSS c32

Z. Klos and K. Stasiewicz *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 67-71 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 20N

A provisional method for determining the hours and frequencies at which solar flares cause major radiopath absorption increase is presented. This technique is incorporated in a computer program for monthly radio propagation prediction. J.M.S.

N80-18469*# Crimean Astrophysical Observatory (USSR).

SOVIET SHORT-TERM FORECASTS OF ACTIVE REGION EVOLUTION AND FLARE ACTIVITY c92

A. B. Severny, N. N. Stepanyan, and N. V. Steshenko *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 72-88 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 03B

The structure and strength of the magnetic fields of the Sun's active regions were studied to obtain information for short term forecasting. Intensity forecasts were then made using the information obtained on the gradients of the magnetic fields between sunspots of opposite polarity. A comparison of flare forecasting methods is presented. R.E.S.

N80-18470*# Institute of Applied Geophysics, Moscow (USSR).

FORECASTING OF SOLAR ENERGETIC RADIATION AT THE FORECAST CENTER OF THE INSTITUTE OF APPLIED GEOPHYSICS c92

S. I. Avdyushin, N. K. Pereyaslova, F. L. Dlikman, and Yu. M. Kulagin *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 89-103 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 03B

Solar energetic radiation forecasting techniques are described. The factors that are used as the basis for the forecasts are discussed. R.E.S.

N80-18471*# Institute of Applied Geophysics, Moscow (USSR).

FORECASTING IONOSPHERIC AND GEOMAGNETIC CONDITIONS AT THE IAG FORECASTING CENTER c46

S. I. Avdyushin, A. D. Danilov, A. B. Malyshev, G. N. Novikova, and P. M. Svidsky *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 104-117 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 04A

A description of the Moscow Regional Warning Center activity in the field of geomagnetic and ionospheric forecasting is presented. R.E.S.

N80-18472*# National Physical Lab., New Delhi (India). Radio Science Div.

LONG TERM SOLAR ACTIVITY AND IONOSPHERIC PREDICTION SERVICES RENDERED BY THE NATIONAL PHYSICAL LABORATORY, NEW DELHI c32

B. M. Reddy, S. Aggarwal, D. R. Lakshmi, S. Shastri, and A. P. Mitra *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 118-133 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 20N

The data base used in solar and ionospheric prediction services is described. Present prediction techniques are discussed and compared with actual observations. Future prediction techniques using computers are also discussed. R.E.S.

N80-18473*# National Physical Lab., New Delhi (India).

A SIMPLIFIED INDEXING OF F-REGION GEOPHYSICAL NOISE AT LOW LATITUDES c46

S. Aggarwal, D. R. Lakshmi, and B. M. Reddy *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 134-139 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 04A

A simple method of deriving an F-region index that can warn the prediction users at low latitudes as to the specific months when they have to be more careful in using the long term predictions is described. R.E.S.

N80-18474*# Academia Sinica, Kunming (China). Yunnan Observatory.

SPIRAL SUNSPOTS AND SOLAR ACTIVITY FORECASTS c92

Ding You-ji and Zhang Bai-rong *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 140-153 refs (For primary document see N80-18462 09-42)

Avail: NTIS MF A01; SOD HC CSCL 03B

The definition of a spiral sunspot is given. Three examples are described which illustrate the processes of the occurrence of spiral sunspots and the roles played by them in prominence and flare activities. A method for solar activity forecasts is then proposed making use of parameters such as spiral sunspots, prominences and neutral lines. R.E.S.

N80-18475*# Academy of Sciences, Peking (China). Solar Activity Prediction Group.

SOLAR ACTIVITY PREDICTIONS AT PEKING OBSERVATORY c92

In NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 154-162 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Solar activity prediction procedures used at the Peking Observatory are briefly reviewed. Methods for short term prediction of solar proton events and the results for proton events of importance greater than 1 during the period 1974-1977 are given in detail. The characteristic values of solar cycle 21 are predicted. Author

N80-18476*# Academia Sinica, Nanking (China). Purple Mountain Observatory.

LONG-TERM FORECASTING OF SOLAR ACTIVITY c92

Xu Zhen-Tao, Zhao Ai-Di, Mei Yan-Lin, and Guo Quan-Shi *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 163-175 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Corrections to the forecast of the basic parameters of the 21st cycle are described. Estimates about the level of solar activity in the 22nd cycle are presented. R.E.S.

N80-18477*# Academia Sinica, Nanking (China). Solar Activity Prediction Group.

SHORT-TERM SOLAR ACTIVITY FORECASTING c92

Chen Xie-Zhen and Zhao Ai-Di *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 176-181 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

A method of forecasting the level of activity of every active region on the surface of the Sun within one to three days is proposed in order to estimate the possibility of the occurrence of ionospheric disturbances and proton events. The forecasting method is a probability process based on statistics. In many of the cases, the accuracy in predicting the short term solar activity was in the range of 70%, although there were many false alarms. M.M.M.

N80-18478*# Radio Research Labs., Nakaminato (Japan).

FORECASTS OF GEOMAGNETIC ACTIVITIES AND HF RADIO PROPAGATION CONDITIONS MADE AT HIRAISO/JAPAN c32

K. Marubashi, Y. Miyamoto, T. Kidokoro, and T. Ishii *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 182-204 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

The Hiraiso Branch of RRL prediction techniques are summarized separately for the 27 day recurrent storm and the flare-associated storm. The storm predictions are compared with the actual geomagnetic activities in two ways. The first one is the comparison on a day to day basis. In the second comparison, the accuracy of the storm predictions during 1965-1976 are evaluated. In addition to the storm prediction, short-term predictions of HF radio propagation conditions are conducted at Hiraiso. The HF propagation predictions are briefly described as an example of the applications of the magnetic storm prediction. M.M.M.

N80-18479*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.

A REVIEW OF SHORT-TERM FLARE FORECASTING ACTIVITIES AT TOYOKAWA c92

Shinzo Enome *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 205-211 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

Short-term forecasting of solar activity conducted at Toyokawa is briefly reviewed. The forecasts are based on microwave observations of the slowly varying component of solar radiation associated with active regions. It was found that for proton flares which take place in intense active regions, it is possible to predict their occurrence with certain accuracy, but for a certain class of proton flares which occur in a small active region or which are associated with an active region, which evolves very rapidly, or for whose which occur behind the limb, it is almost impossible to forecast their occurrence. M.M.M.

N80-18480*# Radio Research Labs., Tokyo (Japan).

RADIO PROPAGATION PREDICTION SERVICES IN JAPAN c32

Rikio Maeda *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 212-222 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

Japanese prediction services for HF radio communications are outlined in relation to prediction method, performance and evaluation. The current prediction is based on the CCIR interim method with some modifications matching to a computer system. The principal service is the monthly median prediction issued regularly three months in advance for various communication circuits. A daily prediction for short distance circuits is being prepared by using real time ionospheric sounding data. An evaluation theory and practice is expected to be introduced in the future prediction service. M.M.M.

N80-18481*# Radio Research Labs., Tokyo (Japan).

RADIO DISTURBANCE WARNING ISSUANCE SYSTEM c32

Rikio Maeda and Hisao Inuki *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 223-228 (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

A radio disturbance warning issuance system was introduced in the Hiraiso Branch of the Radio Research Laboratories in 1972 to reconstruct the current radio disturbance warning service as a social information service. A description of the new ideas which were experimentally systematized by means of an electronic computer is presented. M.M.M.

N80-18482*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.

A REVIEW OF THE OPERATION OF THE IUWDS REGIONAL WARNING CENTRE AT THE IONOSPHERIC PREDICTION SERVICE, SYDNEY c46

F. E. Cook and P. Davies *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 229-238 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The operation of the Sydney Regional Warning Centre is reviewed. Routine data reports are issued daily, while disturbance warnings (short-term forecasts) are issued as necessary. An outline of the methods used in forecasting solar activity and geomagnetic disturbances is given. Author

N80-18483*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.

A DISTURBANCE FORECASTER'S VIEW OF THE SEPTEMBER 1977 EVENTS c46

F. E. Cook *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 239-248 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The solar-geophysical events of 1977 September 7-26 are presented. A variety of disturbance forecasting problems, viz. disc transit of a center of activity with high microwave flux but relatively low meter-wave flux, flares in this region near east limb, central meridian, and west limb with major radio events, and the presence of two coronal holes, were observed. The Sydney daily GEOSYD message and IPS Disturbance Warnings issued during this period are related to the solar geophysical data available, at the time, about these events. M.M.M.

N80-18484*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.

THE USE OF IONOSPHERIC INDICES TO MAKE REAL- AND NEAR-REAL-TIME FORECASTS OF foF2 AROUND AUSTRALIA c46

L. F. McNamara *In* NOAA Solar-Terrest. Prediction Proc., Vol. 1 Aug. 1979 p 249-258 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

Two computer programs are used to forecast foF2 at points around Australia from daily and hourly ionospheric indices. It is found that for forecasts one day ahead, the most accurate results are obtained using the past variations of foF2 at several stations to determine a latitudinal-average daily ionospheric index. Forecasts made with lead times of zero to three hours do not offer significant improvements over those made one day ahead. K.L.

N80-18485*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
PREDICTION LIMITS FOR foF2 c46
P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 259-278 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

Some of the factors limiting the prediction of foF2 are investigated using median and hourly foF2 values recorded at stations in the Australian ionosonde network. Different time and spatial scales together with different levels of solar and geomagnetic activity are considered. All data used in the analysis are displayed in a series of scatter diagrams which provide an overall view of the accuracy limits for foF2 predictions. K.L.

N80-18486*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A WEEKLY IONOSPHERIC INDEX c46
J. F. Turner and P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 279-287 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The monthly and weekly T indices are discussed. Some possibilities for improving the reliability of the weekly T index are considered, including extending its applicability to daily variations of the global ionosphere. K.L.

N80-18487*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
CORONAL HOLES INFERRED FROM THE FLEURS EAST-WEST SOLAR SCANS c92
Brian G. Ferguson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 288-311 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

East-West solar scans produced daily on 692 and 1415 MHz are analyzed for the period 1968 to 1973. The analysis confirms that coronal holes are stable features displaying significantly reduced electromagnetic emission which can persist for many solar rotations. The coronal hole observations are summarized in a series of tables. K.L.

N80-18488*# Naval Ocean Systems Center, San Diego, Calif.
PROPHET: AN APPLICATON OF PROPAGATION FORECASTING PRINCIPLES c32
Paul E. Argo and Ilan J. Rothmuller *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 312-321 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 20N

A propagation assessment and forecasting terminal, PROPHET, is described. The terminal is a key element of the environmental prediction and assessment system which uses real time solar/geophysical data to provide real time knowledge of propagation conditions. The terminal uses models to translate data from satellite and ground based sources into performance predictions for specific systems. K.L.

N80-18489*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
PREDICTIONS OF THE SPACE ENVIRONMENT SERVICES CENTER c46
G. R. Heckman *In its* Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 322-349 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The types of users of the Space Environment Services Center are identified. All the data collected by the Center are listed and a short description of each primary index or activity summary is given. Each type of regularly produced forecast is described, along with the methods used to produce each prediction. K.L.

N80-18490*# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOPHYSICAL FORECASTING AT AFGWC c46
Richard L. Thompson and James A. Secan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 350-366 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

Methods for forecasting the state of the space environment, Sun, interplanetary field, magnetosphere, and ionosphere are discussed. Areas requiring scientific advancements to support the increasing operational requirements of systems that use or are affected by the environment above 50 km are identified. K.L.

N80-18491*# Air Force Global Weather Central, Offutt AFB, Nebraska.
IONOSPHERIC MODELING AT AIR FORCE GLOBAL WEATHER CENTRAL c46
Thomas F. Tascione, Thomas W. Flattery, Vernon G. Patterson, James A. Secan, and James W. Taylor, Jr. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 367-377 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

The four Dimensional Ionospheric Model (4-D) is described. The 4-D integrates a wide variety of ionospheric data types into a consistent ionospheric specification. At each observing location, the 4-D reduces an entire electron density profile to four weighting coefficients. These weighting coefficients are interconnected in time and space by spectral analysis techniques. The resultant field of spectral coefficients can be used to reconstruct an electron density profile at any latitude, longitude and time. R.C.T.

N80-18492*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SOLAR ACTIVITY PREDICTIONS FOR SATELLITE ORBITAL LIFETIME ESTIMATION c92
H. C. Fuler, C. A. Lundquist, and W. W. Vaughan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 378-384 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

The procedure to predict solar activity indexes for use in upper atmosphere density models is given together with an example of the performance. The prediction procedure employs a least square linear regression model to generate the predicted smoothed vinculum R sub 13 and geomagnetic vinculum A sub p(13) values. Linear regression equations are then employed to compute corresponding vinculum F sub 10.7(13) solar flux values from the predicted vinculum R sub 13 values. The output is issued principally for satellite orbital lifetime estimations. R.C.T.

N80-18493*# Michigan Univ., Pontiac. McMath-Hulbert Observatory.
EXAMPLES OF PROBLEM FLARES OR SITUATIONS IN PAST SOLAR-TERRESTRIAL OBSERVATIONS c92
H. W. Dodson, E. R. Hedeman, and O. C. Mohler *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 385-397 refs Sponsored in part by APL/JHU (For primary document see N80-18462 09-42)
(Grants NGL-23-005-275; NOAA-03-4-022-94)
Avail: NTIS MF A01; SOD HC CSCL 03B

Instances of solar activity are disscused in terms of their relative interference with making solar terrestrial observations. Unexpected flares of significance are reported and the geophysical effects of these flares are noted. R.C.T.

N80-18494*# Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
FORECASTS OF GEOMAGNETIC ACTIVITY BY OTTAWA MAGNETIC OBSERVATORY: THEIR RELIABILTY AND APPLICATION c46
J. Hruska *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 398-405 refs Sponsored in part by NOAA (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

A 27 day forecast of geomagnetic activity based on the forecasts from two locations is presented. To evaluate the reliability of the forecasts, the predicted activity was compared with the actual geomagnetic activity at five geomagnetic observatories located in different magnetic zones: Ottawa (57.0N, 351.5E);

Meanook (61.8N, 301.0E); Fort Churchill (68.8N, 322.5E); Cambridge Bay (76.7N, 294.0E); and Resolute Bay (83.1N, 287.7E). Results indicate that the percentage of correct predictions varies with the geomagnetic latitude of the observatory used for comparison. The percentage is on the average highest for lower latitude stations and lowest for the northern stations. The number of incorrect predictions ranges from 4.7% for Ottawa to 8.4% for Churchill. R.C.T.

N80-18495*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PPS76: A COMPUTERIZED EVENT MODE SOLAR PROTON FORECASTING TECHNIQUE c92
D. F. Smart and M. A. Shea *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 406-427 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

A procedure was developed to generate a computerized time intensity profile of the solar proton intensity expected at the Earth after the occurrence of a significant solar flares on the Sun. A combination of many pieces of independent research and theoretical results are included. A construction of selected experimental and theoretical results from the entire domain of solar terrestrial physics is given. R.C.T.

N80-18496# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LAND USE AND CLIMATOLOGICAL PARAMETERS IN HUMID TROPICS [O CLIMA E O USO DA TERRA NOS TROPICOS UMIDOS]
Luiz Carlos Baldicero Molion and Juan Jose Verdesio Bentancurt Nov. 1979 28 p refs In PORTUGUESE; ENGLISH summary Presented at the 2d Simp. Nacl. de Ecol., Belem, Portugal, 19-24 Nov. 1979
(INPE-1630-RPE/092) Avail: NTIS HC A03/MF A01

The interaction of climatological parameters with different land use systems in the humid tropics is discussed. The climate of humid tropical regions is characterized as a function of large scale parameters and the differences of the energy and water balances terms over different ground cover types are discussed. It is shown that humid forests have a higher net radiation flux when compared to different cover types and, therefore, have more energy available to vaporize water. Consequently, the changeover from forest to other land uses modifies the regional climate. An attempt is made to identify techniques which would attenuate the land use effects on the climate of tropical regions. M.G.

N80-18497*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUMERICAL CALCULATION OF STEADY INVISCID FULL POTENTIAL COMPRESSIBLE FLOW ABOUT WIND TURBINE BLADES
Djordje S. Dulikravich 1980 11 p refs Presented at the Wind Energy Conf., Boulder, Colo., 9-11 Apr. 1980; sponsored by AIAA and Midwest Energy Research Inst.
(NASA-TM-81438; E-361; AIAA-Paper-80-0607) Avail: NTIS HC A02/MF A01 CSCL 10B

An exact nonlinear mathematical model that accounts for three-dimensional cascade effects about the inner portions of the rotor blades and compressibility effects about the tip regions of the blades was derived. An artificially time dependent version was iteratively solved by a finite volume technique involving an artificial viscosity and a three-level consecutive mesh refinement. The exact boundary conditions were applied by generating a boundary conforming periodic computation mesh. K.L.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N80-18498* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RADAR TARGET FOR REMOTELY SENSING HYDROLOGICAL PHENOMENA Patent
Wilford E. Sivertson, Jr., inventor (to NASA) Issued 15 Jan. 1980 6 p Filed 22 Sep. 1978 Supersedes N78-33511 (16 - 24, p 3231)
(NASA-Case-LAR-12344-1; US-Patent-4,184,155;
US-Patent-Appl-SN-945041; US-Patent-Class-343-5CM;
US-Patent-Class-343-5W; US-Patent-Class-343-18B;
US-Patent-Class-343-18D) Avail: U.S. Patent and Trademark Office CSCL 08H

An apparatus for remotely measuring and accessing water status relative to snow and glacial melt, surface runoff, rainfall, evaporation, flow rate, and soil moisture is described. A radar target located at a selected location on the surface of the Earth is designed to collect water and render its cross sectional area variable as a function of the height of the water level within the target. The target is remotely monitored by an orbiting or airborne synthetic aperature radar. The target appears as a bright spot embedded within the radar image. The target brightness is indicative of the height of the water level within the ground located target.

Official Gazette of the U.S. Patent and Trademark Office

N80-18499 Kansas Univ., Lawrence.
AN EVALUATION OF MAP DESIGN AND MAP READING USING EYE MOVEMENT RECORDINGS Ph.D. Thesis
Theodore R. Steinke 1979 335 p
Avail: Univ. Microfilms Order No. 8002766

The eye movements of 60 subjects looking at a map were recorded using a coreal reflection technique in order to determine the parts of the map being observed, the time spent looking at the various parts, and the scanning sequence. One of three maps (having the same basic map body but with varying amounts of surrounding information) was shown to each group of 20 subjects to ascertain the effect of map design on map reading ability. All subjects reconstructed the map from memory shortly after eye movement recording. Analysis of the film shows attention was directed to the map body, title, and legend. The average time spent looking at the map was about 22 seconds, but ranged from 12.6 to 40.3 seconds. Reading was begun in the central and upper part of the map body or on the title. After this the gaze moved in very diverse directions with little unaminity in the location of the part last observed. There were relatively few differences in the way the maps transmitted geographic information to the readers as revealed by map reconstruction; however, maps with little or no surrounding information seem to function more efficiently. Dissert. Abstr.

N80-18500* Oregon State Univ., Corvallis.
AN INVESTIGATION OF THE UTILITY OF LANDSAT 2 MSS DATA TO THE FIRE-DANGER RATING AREA, AND FOREST FUEL ANALYSIS WITHIN CRATER LAKE NATIONAL PARK, OREGON Ph.D. Thesis
Hassan Alizadeh Rabii 1979 434 p
Avail: Univ. Microfilms Order No. 8002679

Downed forest fuel tonnage/acre within Crater Lake National Park was inventoried and mapped using LANDSAT multispectral data in conjunction with National Cartographic Information Center (NCIC) digital topographic Information. Interactive classification capability of a Nova 840 computer system and its video color display provided identification and mapping criteria for classification of various surface and cover types within the park. Ground truth information was utilized to correlate the MSS/topographic data set to color IR aerial photographic data. Dissert. Abstr.

N80-18501 Colorado Univ. at Boulder.
MASS BALANCE AND ASPECTS OF THE GLACIER ENVIRONMENT, FRONT RANGE, COLORADO, 1969-1973 Ph.D. Thesis
James Benjamin Johnson 1979 308 p
Avail: Univ. Microfilms Order No. 8002987

Study of the topoclimate of the Arapaho Glacier and the Arikaree Glacier established solar radiation as a predominant factor in controlling the mass balance of glaciers in the Indian Peaks region of the Colorado Front Range. Due to avalanching from the cirque walls and the wind drift into the basins, snow accumulates to average depths of 5.5 m exceeding the regional accumulation. Ablation removes most of the snow pack each year. Albedos vary from around 0.8 in the early ablation season down to 0.4 at the end of the summer. The change occurs primarily due to the accumulation of dust and debris at the surface of the snow pack and the amount of this contamination is the major control on the melt rates. The fact that this controlling factor exists suggests that melting of the glaciers can be augmented artifically be adding darkening materials to the early summer snow cover if desired. Accelerated melting would then leave a deeper topographic catchment for the next winter accumulation and potentially increase the water supply available from the alpine areas. Dissert. Abstr.

N80-18502 Florida Univ., Gainesville.
ANALYSIS OF FRESHWATER LENS FORMATION IN SALINE AQUIFERS Ph.D. Thesis
John Patrick Glass 1979 189 p
Avail: Univ. Microfilms Order No. 8002860

Results of laboratory tests using vertical Hele-Shaw models to determine the shape and rate of movement of the initially vertical interface between two fluids of different density show that, for relatively thick aquifers, it is not correct to neglect the vertical components of flow as has formerly been done. An analytical method is presented for the location of the boundary of a steady freshwater lens in a coastal aquifer. A pair of coupled ordinary differential equations is derived which describe the steady flow of freshwater injected into a leaky saline aquifer under the Dupuit assumption. A three dimensional finite element model is developed which can be used to locate the boundaries of a steady freshwater lens under a wide variety of conditions. A finite difference model developed for the U.S. Geological Survey is used to analyze the axisymmetric flow in transient freshwater lenses. Dissert. Abstr.

N80-18503 Utah State Univ., Logan.
WATERSHED CONSTITUENT LOADING ANALYSIS UTILIZING EMPIRICAL HYDROCHEMICAL MODELING TECHNIQUES Ph.D. Thesis
Jerald Stevens Fifield 1980 206 p
Avail: Univ. Microfilms Order No. 8005104

A simple modification to a hydrologic model in order to create a hydrochemical model is discussed and verified. Two basins along the Colorado River (the Grand Valley, Colorado, and Palo Verde, California) as well as along the Arkansas River in Colorado and Yakima River in Washington were used to acquire stream quality and quantity data. The modified deterministic model was calibrated on 80,200 acres of the Grand Valley, Colorado. Subsequent management runs indicate that only a net minimal reduction of salt loading to the Colorado River will be realized by lining canals, laterals and ditches whereas substantial reduction will result upon increased farm efficiency and/or reduction of spills. When optimal management conditions are met, sulfate will decrease the most and potassium the least. Dissert. Abstr.

N80-18504 California Univ., Davis.
TURBULENT MIXING PROCESSES IN A PARTIALLY MIXED ESTUARY Ph.D. Thesis
Robert Carl MacArthur 1979 341 p
Avail: Univ. Microfilms Order No. 8003523

A method of estimating the nature and magnitude of the parameters which describes the flow, in the region near the bed, located below the maximum density gradient in partially mixed estuaries is developed and validated. Accurate determination of these parameters allows the calculation of the vertical profiles of velocity and an estimation of the vertical turbulent mixing coefficients within this region. Calculated values of the local bed shear stress obtained from numerically integrating a form of the two dimensional momentum equation were found to be accurate when compared to the measured sediment bed shear strengths for various orders of aggregation throughout a mean tide. Orderly flows occur during specific periods of time during a tidal cycle and only within certain vertical regions of the flow within the Savannah estuary. Criteria are developed to be able to identify these periods of fully developed flow.
Dissert. Abstr.

N80-18505 Utah State Univ., Logan.
FEATURE SELECTION AND CLASSIFIER DESIGN WITH APPLICATIONS TO REMOTE SENSING OF MULE DEER Ph.D. Thesis
Manmohan M. Trivedi 1980 134 p
Avail: Univ. Microfilms Order No. 8005119

The deer detection problem where the classification is performed in a multidimensional feature space. A generalized scene, of which the winter range may be considered typical is used in the classification. It includes the deer, evergreen trees, sagebrush, and dry brush against a snow background. A general interclass feature selection procedure, based upon clustering technique, was formulated and used to select best feature sets for the analysis. The classification performance was estimated by considering the a priori probabilities of 'not-deer' objects sufficiently high to eliminate the misclassification of not-deer objects into deer class. The three or four feature classifier was shown to be capable of providing useful deer census data in an operational system when combined with appropriate spatial classification techniques. Dissert. Abstr.

N80-18506*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES Final Report, 15 Nov. 1978 - 14 Nov. 1979
Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 217 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10054; NASA-CR-160421; ERIM-132400-29-1F; SR-E9-00404) Avail: NTIS HC A10/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18507*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
DEVLEOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES: APPENDICES Final Report, 15 Nov. 1978 - 14 Nov. 1979
Q. A Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 303 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15476; Proj. AgRISTARS)
(E80-10055; NASA-CR-160422; ERIM-132400-29-2F; SR-E9-00404) Avail: NTIS HC A14/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18508*# Houston Univ., Tex. Dept. of Mathematics.
DEVELOPMENT OF MATHEMATICAL TECHNIQUES FOR THE ANALYSIS OF REMOTE SENSING DATA Final Report, 1 Dec. 1978 - 31 Dec. 1979
H. P. Jr. Decell, B. C. Peters, W. A. Coberly, F. Kampe, and T. Nguyen, Principal Investigators 31 Dec. 1979 31 p refs ERTS
(Contract NAS9-15543)
(E80-10056; NASA-CR-160445) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-18509*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THREE-CATEGORY CLASSIFICATION
K. A. Havens and K. M. Abotteen, Principal Investigators Aug. 1979 45 p refs Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10058; NASA-CR-160436; JSC-16012; LEC-13498) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following signficant results. Examination of both machine estimates and stratified areal estimates produced by clustering and classification reveal no significant differences between the proportion estimates and ground truth estimates. When testing the variances of the machine estimates, a significant reduction in the variances was found when the number of starting dots was increased from 30 to 45. The variances were again reduced, although not significantly, when the number of starting dots was increased from 45 to 60. From these results, 60 starting dots are recommended for a three-category classifier. When examining the variances of the estimates for the four estimation procedures (using 60 dots), no significant differences were found between procedures. Thus, only the machine clustering may be used to produce an estimate, and the stratified areal estimate computations and maximum likelihood classification can be deleted.

N80-18510*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LACIE TRANSITION YEAR PLAN FOR THE DIRECT ESTIMATION OF WHEAT FROM LANDSAT IMAGERY
R. K. Lennington, N. E. Marquina, D. T. Register, and M. C. Kinsler, Principal Investigators Mar. 1979 51 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10059; NASA-CR-160426; JSC-14553; LEC-11861) Avail: NTIS HC A04/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18511*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
IMPLEMENTATION OF BADHWAR CLASSIFICATION OF CORN/SOYBEAN SEGMENTS
Willa W. Austin, Principal Investigator Oct. 1979 32 p refs ERTS
(Contract NAS9-15800)
(E80-10060; NASA-CR-160425; JSC-16274; LEC-14064) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18512*# Department of Industry, London (England).
SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, 1 Sep. - 31 Dec. 1979
Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Dec. 1979 27 p Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10062; NASA-CR-162584; PR-2-14/P6; PR-2) Avail: NTIS HC A03/MF A01 CSCL 13B

The author has identified the following significant results. Image processing techniques developed are well adapted to the exploration and isolation of local areas which exhibit small temperature differences between themselves and their surroundings. In the worst case of imagery of small areal extent of sea surface having no coastal boundary in the area, there is yet no method of distinguishing unambiguously an oil spill from fog, cloud, the effect produced by shallow sediments, or the effects of naturally occuring thermal fronts. In the case of uniform slicks of liquid North Sea oil in still air, laboratory simulation experiments show that, for oil thicknesses in excess of 1 or 2 mm, there is, under equilibrium conditions, little dependence of oil surface temperature on the thickness of the oil layer. The surface temperature of oil is consistently higher than that of water, the difference being about 1 K at low values of relative humidity, but tending to increase as the relative humidity increases.

N80-18513*# Texas A&M Univ., College Station. Remote Sensing Center.
CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Feb. - Aug. 1979
Bruce J. Blanchard, Principal Investigator Aug. 1979 66 p refs ERTS
(Grant NsG-5193)
(E80-10063; NASA-CR-162585; RSC-3622-2) Avail: NTIS HC A04/MF A01 CSCL 08M

There are no author-identified significant results in this report.

N80-18514*# Texas A&M Univ., College Station. Remote Sensing Center.
MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1979 - 1 Jan. 1980
Bruce J. Blanchard, Principal Investigator 1 Jan. 1980 71 p ERTS
(Grant NsG-5134)
(E80-10064; NASA-CR-162586; RSC-3458-4) Avail: NTIS HC A04/MF A01 CSCL 08M

The author has identified the following significant results. Cursory examination of the data indicates that the listed row tillage practices at 90 deg to the radar beam are approximately 12.5db higher than other comparable agricultural land. The Seasat radar data show evidence that the high return occurs only at a narrow range in look direction near the 90 deg. Such a high increase in return compared to a 15db range in film response would indicate that rows seen crosswise would saturate optically processed data. This response to row direction will have an adverse effect on monitoring agricultural lands with L band radar systems. Preliminary examination indicates that there is no sensitivity to soil moisture at the 5 deg look angle when using a like-polarized L band system. Some sensitivity was evident at a look angle of 20 deg and only a weak sensitivity was indicated at 40 deg look angle. At both 20 deg and 40 deg there is a significant response to soil moisture and none to row direction. Steep angles or the 5 deg look angle using cross polarized (HB) L band system appear insensitive to row direction and soil moisture.

N80-18515*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Jul. - 30 Sep. 1979
R. P. Mroczynski, Principal Investigator 30 Sep. 1979 56 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15325)
(E80-10065; NASA-CR-160435; LARS-093079) Avail: NTIS HC A04/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-18516*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator 21 Jan. 1980 2 p HCMM
(Contract NAS5-24479)
(E80-10067; NASA-CR-162588) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Detailed examination of Nite-IR images of intermontane basins in arid and/or semiarid areas of California discloses a ring or halo of relatively lighter greytone around the edges of each basin. Intermontane basins in the Northern Coast Range, however, do not show this thermal haloing. The topographic elevation of the haloes in arid basins shows seasonal variation, but it is present on nearly all images. A similar halo encircles many of the volcanoes on the Modoc Plateau and Southern Cascade Range. Although the halo around the arid intermontane basins can possibly be explained in relation to the location of alluvial fans (and perhaps water content of the rocks), a similar explanation cannot be made for the haloes around volcanoes or for the lack of haloes around basins in the Coast Range. Atmospheric thermal layering may be an alternative explanation; however, this explanation is also riddled with inconsistencies.

N80-18517*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATION OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 18 Jan. 1980 4 p Sponsored by NASA HCMM
(E80-10068; NASA-CR-162639) Avail: NTIS HC A02/MF A01 CSCL 08L

There are no author-identified significant results in this report.

N80-18518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE EVALUATION AND OUTLOOK PANEL TRANSCRIPT: THE LACIE SYMPOSIUM
1978 22 p refs Symp. held at Houston, Tex., 23 Oct. 1978 Sponsored by NASA, NOAA, and USDA ERTS
(E80-10069; NASA-CR-162641; JSC-13769) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18519*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). BIBLIOGRAPHIC ADDENDA, TECHNICAL REPORTS, PAPERS, AND MEMORANDUMS PUBLISHED UNDER SUPPORTING RESEARCH AND TECHNOLOGY AND OTHER RESEARCH, TEST, AND EVALUATION CONTRACTS FOR THE EARTH OBSERVATIONS DIVISION
J. B. Aumann, Principal Investigator May 1978 37 p ERTS
(Contract NAS9-15200)
(E80-10070; NASA-CR-160423; JSC-14278; LEC-11651) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-18520*# Calspan Advanced Technology Center, Buffalo, N.Y.
APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1979
23 Nov. 1979 4 p HCMM
(Contract NAS5-24263)
(E80-10071; NASA-CR-162642; QR-9) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-18521*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Sep. - 1 Dec. 1979
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Dec. 1979 8 p HCMM
(NASA Order S-4019-8B)
(E80-10072; NASA-CR-162643) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Procedures to edit cloud-contaminated pixels from those pixels representing Earth surface features were investigated. Because clouds are more reflective than Earth features and are colder than Earth surface features most of the year at 26 N latitude, either a raw digital count ratio or a ratio of reflectance percentage for the VIS band to the temperature works well. For this procedure, the two bands of data need to be registered to the ground scene.

N80-18522*# Texas A&M Univ., College Station. Remote Sensing Center.
CONTINUATION OF MEASUREMENT OF HYDROLOGIC SOIL-COVER COMPLEX WITH AIRBORNE SCATTEROMETERS Final Report
Bruce J. Blanchard, John L. Nieber, and Andrew J. Blanchard, Principal Investigators [1979] 48 p refs ERTS
(Grant NsG-5156)
(E80-10073; NASA-CR-162644; FR-3496) Avail: NTIS HC A03/MF A01 CSCL 08M

The author has identified the following significant results. Analysis of radar scatterometry data obtained over five flight lines in Texas by NASA C-130 aircraft demonstrated that multivariant radar data can be used to distinguish difference in land use, and hence be an indicator of surface runoff characteristics. The capability of using microwave sensors to detect flood inundation of timbered land was also determined.

N80-18523*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITONS AS SEEN BY HCMM Progress Report, Jul. - Oct. 1979
W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Oct. 1979 13 p HCMM
(Contract NAS5-24383)
(E80-10074; NASA-CR-162645; PR-3712-7) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18524*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Oct. - Dec. 1979
Donald G. Moore, Principal Investigator and J. L. Heilman Dec. 1979 59 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, MD 20771. Domestic users send orders to 'Attn: National Space Science Data Center', non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NAS5-24206)
(E80-10075; NASA-CR-162646; SDSU-RSI-80-01) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Evidence of a heat sink produced by perched water tables was detected with HCMM night thermal data. The region of shallow water was not visible on HCMM visible or day IR imagery. The results are consistant with previous aircraft investigations.

N80-18525*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 2
M. H. Trenchard, M. L. Sestak, M. C. Kinsler, and D. E. Phinney, Principal Investigators Jun. 1979 194 p Sponsored by NASA, NOAA, and USDA ERTS
(Contract NAS9-15800)
(E80-10076; NASA-CR-160437; JSC-14901-Vol-2; LEC-13393-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18526*# Texas A&M Univ., College Station. Dept. of Mathematics.
AGRISTARS: A JOINT PROGRAM FOR AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING. DEVELOPMENT AND EVALUATION OF CLUSTERING PROCEDURES Final Report
L. F. Guseman, Jr., Principal Investigator Nov. 1979 110 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-14689)
(E80-10079; NASA-CR-160427; SR-T9-00402) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report. For individual titles, see N80-18527 through N80-18529.

N80-18527*# Texas A&M Univ., College Station. Dept. of Mathematics.
DISTANCE PRESERVING LINEAR FEATURE SELECTION Final Report
L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In its* AgRISTARS: A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 22 p refs ERTS (For primary document see N80-18526 09-43)
(Rept-19) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18528*# Texas A&M Univ., College Station. Dept. of Mathematics.

THE EASY REMOTE SENSING PROBLEM Final Report

L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In its* AgRISTARS: A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing Nov. 1979 52 p refs ERTS (For primary document see N80-18526 09-43)

(Rept-20) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18529*# Texas A&M Univ., College Station. Dept. of Mathematics.

THE CRAMER-RAO LOWER BOUND AS A CRITERIA FOR EVALUATING A LARGE DATA REDUCTION SYSTEM SUCH AS LACIE Final Report

L. F. Guseman, Jr., Principal Investigator and Patrick L. Odell (Texas Univ. at Dallas) *In its* AgRISTARS: A Joint Program for Agriculture and Resource Inventoty Surveys Through Aerospace Remote Sensing Nov. 1979 24 p refs ERTS (For primary document see N80-18526 09-43)

(Rept-21) Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-18530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EFFECT OF SOIL TEXTURE ON THE MICROWAVE EMISSION FROM SOILS

Thomas Schmugge Jan. 1980 32 p refs

(NASA-TM-80632) Avail: NTIS HC A03/MF A01 CSCL 08M

The intensity brightness temperature of the microwave emission from the soil is determined primarily by its dielectric properties. The large difference between the dielectric constant of water and that of dry soil produces a strong dependence of the soil's dielectric constant on its moisture content. This dependence is effected by the texture of the soil because the water molecules close to the particle surface are tightly bound and do not contribute significantly to the dielectric properties. Since this surface area is a function of the particle size distribution (soil texture), being larger for clay soils with small particles, and smaller for sandy soils with larger particles; the dielectric properties will depend on soil texture. Laboratory measurements of the dielectric constant for soils are summarized. The dependence of the microwave emission on texture is demonstrated by measurements of brightness temperature from an aircraft platform for a wide range of soil textures. It is concluded that the effect of soil texture differences on the observed values can be normalized by expressing the soil moisture values as a percent field capacity for the soil. A.R.H.

N80-18531# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF STATISTICAL CORRELATION IN THE STUDY OF AVAILABLE WATER IN LAYERS OF CERRADO SOIL [APLICACAO DE MODELOS DE ANALISE ESTATISTICA COM ESTRUTURA CORRELACAO EM ESTUDOS DE DISPONIBILIDADE DE AGUA EM SOLO DOS CERRADOS]

Joel Neves Barreto Oct. 1979 206 p refs In PORTUGUESE; ENGLISH summary

(INPE-1607-TDL/014) Avail: NTIS HC A10/MF A01

The use and extension of the method of time series analysis, as illustrated by the application to studies of the influence of density of planting on the availability of water in different layers of 'Cerrado' soil, is proposed. Three models are elaborated, that take into account, isolated or jointly, the experimental errors correlated both serial and contemporaneously. It is concluded that, for the data analyzed, the averages of the densities, layers and interactions, differ in behavior when analyzed together. The use of this method of analysis, by the adoption of models with correlated errors, is an answer, in specific instances, to the convenience of developing alternate methods of analysis which take into consideration a more adequate correlation structure. M.M.M.

N80-18532# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SIGNIFICANT RESULTS FROM A PROJECT ON AGRICULTURAL STATISTICS, 1975 - 1978 [RESULTADOS SIGNIFICANTES DO PROJETO ESTATISTICAS AGRICOLAS: 1975 - 1978]

Francisco Jose Mendonca, David Chung Liang Lee, Antonio Tebaldi Tardin, Sherry Chou Chen, Rene Antonio Novaes, and Yosio Edemir Shimabukuro Oct. 1979 29 p refs In PORTUGUESE; ENGLISH summary

(INPE-1609-NTE/155) Avail: NTIS HC A03/MF A01

Results acquired by the staff of the Agricultural Statistics Project between 1975 and 1978 are presented. During this period color infrared images and LANDSAT data were interpreted in order to obtain crop identification and area estimates. M.M.M.

N80-18533# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE UTILIZATION OF RADAR IMAGES IN THE GEOLOGICAL MAPPING OF PRE-CAMBRIAN REGION: A PROPOSED MODEL [A UTILIZCAO DE IMAGENS DE RADAR NO MAPEAMENTO DE AREAS PRE-CAMBRIANS: UMA PROPOSICAO DE METOPOLOGIA]

Paulo Roberto Meneses, Chan Chieng Liu, and Waldir Renato Paradella Sep. 1979 14 p In PORTUGUESE Presented at 2nd Regional Symp. of Simposio Regional de Geology Rio Claro, Brazil, 15-18 Nov. 1978 Revised

(INPE-1578-RPE/075) Avail: NTIS HC A02/MF A01

A method for geological mapping in the Pre-Cambrian regions of polycyclic and polyphasic evolution, when radar imagery (scale: 1:250.000) is used as the main data source is proposed. A multistage procedure is adopted in this study. First, a standard geological cross section is selected by data is then used as the basis of the next researching stage, photointerpretation of the radar imagery. It is shown that for a regional geological study, a prior field mapping of standard profils affords greater facility than the conventional procedure in which photointerpretation is made first. M.G.

N80-18534*# Massachusetts Inst. of Tech., Cambridge.

ESTIMATION OF EFFECTIVE HYDROLOGIC PROPERTIES OF SOILS FROM OBSERVATIONS OF VEGETATION DENSITY M.S. Thesis

Tobin Eugene Tellers 1980 125 p refs

(Grant NsG-5306)

(NASA-CR-162797) Avail: NTIS HC A06/MF A01 CSCL 08M

An existing one-dimensional model of the annual water balance is reviewed. Slight improvements are made in the method of calculating the bare soil component of evaporation, and in the way surface retention is handled. A natural selection hypothesis, which specifies the equilibrium vegetation density for a given, water limited, climate-soil system, is verified through comparisons with observed data and is employed in the annual water balance of watersheds in Clinton, Ma., and Santa Paula, Ca., to estimate effective areal average soil properties. Comparison of CDF's of annual basin yield derived using these soil properties with observed CDF's provides excellent verification of the soil-selection procedure. This method of parameterization of the land surface should be useful with present global circulation models, enabling them to account for both the non-linearity in the relationship between soil moisture flux and soil moisture concentration, and the variability of soil properties from place to place over the Earth's surface. Author

N80-18535# Naval Postgraduate School, Monterey, Calif.

STATISTICAL METHODS OF PROBABLE USE FOR UNDERSTANDING REMOTE SENSING DATA

Donald P. Gaver Oct. 1979 40 p refs

(AD-A076908; NPS55-79-020) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report outlines several new statistical approaches to data problems likely to be encountered when remote sensing methods are used. The methods described are robust regression analysis, smoothing, and modeling and estimation of ice pressure ridge characteristics. GRA

N80-18536# Army Engineer Topographic Labs., Fort Belvoir, Va.

SIGNAL SIGNATURES OF TOPOGRAPHIC FEATURES USING ANALOG TECHNOLOGY

Pi-Fuay Chen and William W. Seemuller May 1979 37 p refs
(AD-A076110; ETL-0185) Avail: NTIS HC A03/MF A01 CSCL 09/2

Signal signatures and signatures of various spectral decompositions of selected topographic features, such as line roads, road intersections, and rectangular buildings, were developed by using analog signal processing techniques. The signal signatures were constructed in the spatial domain, and the corresponding signatures of various spectral components were obtained in the Walsh transform domain. An electronic system for generating two-dimensional Walsh functions for decomposition of topographic features was designed and built. A scheme for detecting the decomposed spectral components using an analog processor was presented. GRA

N80-18537# Army Engineer Topographic Labs., Fort Belvoir, Va.

AN EVALUATION OF CONVENTIONAL CORRELATION METHODS WHEN MATCHING INFRARED IMAGERY TO PANCHROMATIC IMAGERY

Michael A. Crombie Aug. 1979 37 p refs
(AD-A076111; ETL-0195) Avail: NTIS HC A03/MF A01 CSCL 09/4

In this report, a practical method of determining parallax by matching an infrared image to a corresponding panchromatic image using conventional correlation methods is evaluated using digitized aerial images. However, from the results of the study, the method was found to be unsatisfactory. GRA

N80-18538# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

RADAR IMAGE SIMULATION OF SEASONALLY DEPENDENT REFERENCE SCENES Contract Report, 27 Mar. - Sep. 1978

J. C. Holtzman, J. E. Bare, V. H. Kaupp, E. E. Komp, and J. A. Stiles Apr. 1979 236 p refs
(Contract DAAK70-78-C-0062)
(AD-A076119; RSL-TR-370-2; ETL-0188) Avail: NTIS HC A11/MF A01 CSCL 17/9

The results are reported from applying radar image simulation to produce simulated reference scenes of winter conditions for a missile guidance usage. A data base was constructed of the Watertown, New York, test site and simulated radar images were generated. The data base was prepared from historical data for an 'average' winter at the test site. Simulated radar images were produced via the point scattering model and an empirical model was used for predicting the electromagnetic reflectance from the ground, its cover, and overlying snow. Copies of the simulated radar images are included. The results reported were obtained for four (4) simulations corresponding to four specific altitudes in the terminal phases of the trajectory of a guided missile, each successively lower. The simulated images have been produced for testing against actual radar data of the same site via the Correlatron. These tests have not been performed as the actual radar data have not yet been obtained. GRA

N80-18539# Science Applications, Inc., Arlington, Va.

PROCEEDINGS OF THE IMAGE UNDERSTANDING WORKSHOP Semiannual Report, Apr. - Nov. 1979

Lee S. Baumann, ed. et al Nov. 1979 187 p refs Conf. held at Los Angeles, 7-8 Nov. 1979
(Contract MDA903-78-C-0095; DARPA Order 3454)
(AD-A077568; SAI-80-974-WA) Avail: NTIS HC A09/MF A01 CSCL 05/8

This document contains the technical papers and outlines of semiannual progress reports presented by the research activities in Image Understanding sponsored by the Information Processing Techniques Office, Defense Advanced Research Projects Agency. The papers were presented at a workshop conducted on 7-8 November 1979 in Los Angeles, California. GRA

N80-18540# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

CHARGED DISLOCATION IN ICE. 1: EXISTENCE AND CHARGE DENSITY MEASUREMENT BY X-RAY TOPOGRAPHY

Kazuhiko Itagaki Nov. 1979 19 p refs
(DA Proj. 4A1-61102-AT-24)
(AD-A078775; CRREL-79-25) Avail: NTIS HC A02/MF A01 CSCL 08/12

The motion of dislocations in single crystal ice under an electric field was observed by using X-ray topographic methods. Electric charge density on these dislocations was deduced from the amplitude and length of the dislocation segment under the known ac electrical field. The most likely linear charge density was about -5 x 10 to the minus 11th power c/m, although considerable variation is possible depending on the effective field acting on the dislocation lines. GRA

N80-18541# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA

W. F. Weeks and A. J. Gow Oct. 1979 29 p refs
(Grant NSF DPP-77-27479; NOAA-01-5-022-1651)
(AD-A077188; CRREL-79-22) Avail: NTIS HC A03/MF A01 CSCL 08/12

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between Bering Strait and Barter Island have shown that the great majority of the ice samples (95%) exhibit striking c-axis alignments within the horizontal plane. Such alignments were usually well developed by the time the ice was 50 cm thick and in some cases when the ice was 20 cm thick. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane are commonly less than + or - 10 deg. for samples collected near the bottom of the ice. The general patterns of the alignments support a correlation between the preferred c-axis direction and the current direction at the ice/water interface. A comparison between c-axis alignments and spot current measurements made at 42 locations shows that the most frequent current direction coincides with the mean c-axis direction. Such alignments are believed to be the result of geometric selection with the most favored orientation being that in which the current flows normal to the (0001) plates of ice that compose the dendritic sea ice/sea after interface. GRA

N80-18542# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

BACKSCATTER MEASUREMENTS OF SEA ICE WITH A HELICOPTER-BORNE SCATTEROMETER

J. S. Patel, R. G. Onstott, C. V. Delker, and R. K. Moore Jul. 1979 132 p refs
(Contract N00014-76-C-1105)
(AD-A077614; RSL-TR-331-13) Avail: NTIS HC A07/MF A01 CSCL 08/12

The purpose of this paper is to describe the design and development of the University of Kansas helicopter-borne scatterometer system, HELOSCAT. The experiments performed to measure the radar backscatter from sea ice with this system along with the results are also described. Backscatter measurements were made at 1-2 GHz and 8-18 GHz frequencies, HH-polarization, and three incidence angles (20, 40, and 60 deg). Different types of ice ranging from thin ice to multiyear ice were observed; however, most data were collected from thick first-year and multiyear ice. A comparison of 1-2 GHz results for thick first-year and multiyear ice shows that the scattering coefficient values for multiyear ice at 60 deg are slightly lower than the value for thick first-year ice. The 8-18 GHz results show that the backscatter from multiyear ice at these frequencies is higher than the backscatter return from thick first-year ice by at least 3-4 dB. The frequency response of backscatter return is an upward sloping straight line on a dB-vs-frequency plot. For the multiyear ice, only the 60 deg data was found usable; the data at 20 deg and 40 deg were determined to be erroneous because of a malfunctioning frequency counter. GRA

N80-18543# Wisconsin Univ. - Madison.

REMOTE MEASUREMENTS OF BOUNDARY LAYER VELOCITY PARAMETERS BY MONOSTATIC LIDAR

Jeffery Thomas Srogs Oct. 1979 132 p refs
(Contract DAAG29-76-C-0136; DA Proj. 1T1-61102-GH-37)
(AD-A078678; ERADCOM/ASL-CR-79-0136-1) Avail: NTIS
HC A07/MF A01 CSCL 17/8

Wind velocity parameters in the planetary boundary layer are measured using spatial inhomogeneities in the natural aerosol content as tracers. Lidar measurements of these spatial inhomogeneities are correlated in time and space to remotely estimate the mean speed, direction and the rms speed variance of the wind velocity. Aerosol inhomogeneities with horizontal dimensions of 60m-0.1km were found to be efficient tracers of the wind. The coherence between spatially and temporally separated lidar profiles of these spatial aerosol inhomogeneities is used to determine the perpendicular components along and across the beam pattern of the horizontal wind velocity. Comparisons between lidar horizontal wind measurements with tower anemometers and pilot balloons show that lidar can remotely sense the boundary layer flow. GRA

N80-18544# Stanford Univ., Calif. Electronic Labs.
REMOTE SENSING OF OCEAN SURFACE CURRENT AND CURRENT SHEAR BY HF BACKSCATTER RADAR
Eng-Chong Ha Aug. 1978 141 p refs
(Contract N00014-75-C-0356)
(AD-A078834; SU-SEL-79-022; SU-TR-D415-1) Avail: NTIS
HC A07/MF A01 CSCL 17/9

The Doppler spectrum of radar return from the sea at HF contains two narrow lines displaced upward and downward from the carrier frequency, resulting from backscatter off ocean surface waves moving toward and away from the radar, respectively. These Bragg lines indicate resonant backscatter which occurs for the ocean waves of length one-half the radio wavelength. The phase velocity of these gravity waves consists of two components; the first is determined by the wavelength and the second by the current component in the direction of wave propagation averaged over depth with an exponential weighting function that has a characteristic scale proportional to the wavelength. The Doppler shift of the radar carrier is determined by the wave phase velocity. Its variation with carrier frequency is thus related to the vertical profile of the current component in the radar direction by a Laplace transform; therein lies the principle of radio measurement of ocean current and its vertical shear. Radio backscatter experiments to verify the feasibility of such measurements were conducted using the radar operating at four frequencies covering the range from 3 to 30 MHz. The depth-averaged radial current deduced from the centroid of the Doppler-shifted sea echo experiments at 6.8, 13.3, 21.7, and 29.8 MHz showed fluctuations on the order of 1 cm/sec superimposed on temporal trends that reached maximum values of about 40 cm/sec. It is concluded that multifrequency backscatter ground-wave radar at HF constitutes a powerful technique for mapping current and its vertical profile in the top few meters of the ocean. GRA

N80-18545# Consiglio Nazionale delle Ricerche, Padua (Italy).
USE OF SATELLITE IMAGERY FOR THE DERIVATION OF THE HYDROGEOLOGIC CHARACTERISTICS OF A TEST AREA IN SEMIARID CLIMATES
Carlo Vaccari (Italeco SpA) and Bruno Marcolongo 29 May 1979 12 p Presented at COSPAR Water Resources Symp., Bangalore, India, 30 May - 1 Jun. 1979
Avail: NTIS HC A02/MF A01

The ability to identify locations of underwater storage is especially important in semiarid areas. To this effect, the application of remote sensing by LANDSAT can lead to the identification of potential sites suitable for further ground exploration, thus curtailing the time, labor, and expense of alternative prospecting procedures. The method described utilizes the radiometric information supplied by LANDSAT, together with existing and readily available ground information, to reconstruct the major hydrogeologic features of a semiarid area and to assess in semiquantitative fashion its potential subsurface water content. Author (ESA)

N80-18546# Science Applications, Inc., La Jolla, Calif.
A PRELIMINARY STUDY OF THE CONSEQUENCES OF DEEP OCEAN MINING TECHNOLOGY TRANSFER Research Report, Oct. - Dec. 1978
P. B. Grote and W. A. Coleman 18 Dec. 1978 105 p
(PB-300723/4; BM-OFR-124-79) Avail: NTIS
HC A06/MF A01 CSCL 08I

The possible transfer of U.S. and other developed country deep ocean mining (DOM) technologies to developing countries is one of several major issues in current United Nations Law of the Seas negotiations. A critique of the various terms and conditions pertaining to technology transfer in recent negotiating tests is presented. The relevant DOM technology, sources of innovation, and methods of proprietary protection are described. Functional requirements for viable technology transfer are developed and used as a basis for the definition of alternative levels of programs and implementation approaches, including required changes in the negotiating text. The consequences of these technology transfer options on the various parties are investigated. GRA

N80-18547# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
GEOTHERMAL ENERGY DEVELOPMENT IN THE EASTERN UNITED STATES. EVALUATION OF POTENTIAL GEOTHERMAL RESOURCE AREAS
Franklin O. Mitchell Jul. 1979 53 p refs
(Contracts EX-76-A-36-1008; DE-A101-79ET-27025)
(PB-299925/8; APL/JHU-QM-79-163-GT) Avail: NTIS
HC A04/MF A01 CSCL 08I

A method for the comparative evaluation of geothermal prospects in the eastern United States in proposed and illustrated. Comparisons are based on quantified data from geologic, engineering, and socio-economic sources including temperature gradient, depth to basement, drilling costs, population, and distribution by town size, as well as energy use in residential, commercial, and industrial applications. GRA

N80-18548# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 4: EXECUTIVE REPORT Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss and Patrick W. Linehan Dec. 1978 50 p refs
(Contract DI-BM-J0255022)
(PB-299890/4; BM-OFR-103(4)-79) Avail: NTIS
HC A03/MF A01; also available in set of 4 reports HC E16, PB-199886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. Preliminary scale model blasts were conducted at a quarry to provide basic data. An analysis of the data obtained from the field tests is presented. Where possible, expressions were developed that can be helpful in establishing guidelines for the design of blasting to minimize adverse results with respect to noise and ground vibration. GRA

N80-18549*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SEASAT GULF OF ALASKA WORKSHOP REPORT
George H. Born (NOAA), John C. Wilkerson (NOAA), John W. Sherman, III, and David B. Lame May 1979 42 p Prepared in cooperation with DOD, Washington, D.C.
(NASA-CR-162463; PB-301417/2; JPL-662-101;
NOAA-79090406) Avail: NTIS HC A03/MF A01 CSCL 08J

Results are presented of an initial evaluation of part of the 105-day Seasat mission, focusing on data obtained from a 30 day experiment conducted in the Gulf of Alaska during August-September 1978. The Gulf of Alaska Seasat Experiment (GOASEX) was the only dedicated surface observation program conducted to validate the satellite data. Initial quantitative Seasat results produced during a Workshop held on January 22-26, 1979 are reported. Based on an early evaluation of these results, it is concluded that some of the original objectives of sensor performance were met. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N80-18550* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF FABRICATING A PHOTOVOLTAIC MODULE OF A SUBSTANTIALLY TRANSPARENT CONSTRUCTION Patent
Paul A. Dillard (Lockheed Missile and Space Co., Sunnyvale, Calif.), Walter M. Fritz (Lockheed Missile and Space Co., Sunnyvale, Calif.), and Dan R. Lott, inventors (to NASA) (Lockheed Missile and Space Co., Sunnyvale, Calif.) Issued 22 Jan. 1980 7 p Filed 26 Jul. 1978 Supersedes N78-28626 (16 - 19, p 2558) Sponsored by NASA
(NASA-Case-NPO-14303-1; NASA-Case-NPO-14305-1;
US-Patent-4,184,903; US-Patent-Appl-SN-928133;
US-Patent-Class-156-104; US-Patent-Class-156-278;
US-Patent-Class-156-285; US-Patent-Class-156-303;
US-Patent-Class-156-312) Avail: U.S. Patent and Trademark Office CSCL 10A

A method characterized by the steps of positioning a plurality of uniformly dimensioned photovoltaic cells in registered relation with a plurality of openings formed in a planar tool is disclosed. The method allows acess to the P contact surface of each of the cells. The steps of the method are: (1) connecting the N contact surface of alternate cells to the P contact surface of the cells interposed therebetween, (2) removing therefrom residue of solder flux, (3) applying to the N contact surfaces of the cells a transparent adhesive, (4) placing a common transparent cover plate in engaged relation with the adhesive, (5) placing a film over the circular openings for hermetically sealing the openings, and (6) establishing a vacuum between the film and the cover plate.

Official Gazette of the U.S. Patent and Trademark Office

N80-18551* National Aeronautics and Space Administration. Pasadena Office, Calif.
DRIVER FOR SOLAR CELL I-V CHARACTERISTIC PLOTS Patent
Gary B. Turner, inventor (to NASA) (JPL) Issued 15 Jan. 1980 6 p Filed 26 Jul. 1978 Supersedes N78-28625 (16 - 19, p 2557) Sponsored by NASA
(NASA-Case-NPO-14096-1; US-Patent-4,184,111;
US-Patent-Appl-SN-928128; US-Patent-Class-324-404;
US-Patent-Class-324-158D) Avail: U.S. Patent and Trademark Office CSCL 10A

A bipolar voltage ramp generator which applies a linear voltage through a resistor to a solar cell for plotting its current versus voltage (I-V) characteristic between short circuit and open circuit conditions is disclosed. The generator has automatic stops at the end points. The resistor serves the multiple purpose of providing a current sensing resistor, setting the full-scale current value, and providing a load line with a slope approximately equal to one, such that it will pass through the origin and the approximate center of the I-V curve with about equal distance from that center to each of the end points.

Official Gazette of the U.S. Patent and Trademark Office

N80-18552* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLAR CELL ANGULAR POSITION TRANSDUCER Patent
Maynard C. Sandford and David L. Gray, inventors (to NASA) Issued 15 Jan. 1980 8 p Filed 9 Feb. 1978 Supersedes N78-18394 (16 - 09, p 1160)
(NASA-Case-LAR-11999-1; US-Patent-4,184,072;
US-Patent-Appl-SN-876299; US-Patent-Class-250-231SE;
US-Patent-Class-250-211K) Avail: U.S. Patent and Trademark Office CSCL 10A

An angular position transducer utilizing photocells and a light source is disclosed. The device uses a fully rotatable baffle which is connected via an actuator shaft to the body whose rotational displacement is to be measured. The baffle blocks the light path between the light source and the photocells so that a constant semicircular beam of light reaches the photocells. The current produced by the photocells is fed through a resistor, a differential amplifier measures the voltage drop across the resistor which indicates the angular position of the actuator shaft and hence of the object.

Official Gazette of the U.S. Patent and Trademark Office

N80-18553 Oklahoma Univ., Norman.
ANALYSIS OF THE GEOTHERMAL BINARY CYCLE USING PARAFFIN HYDROCARBONS AS WORKING FLUIDS Ph.D. Thesis
Khan Zafar Iqbal 1979 301 p
Avail: Univ. Microfilms Order No. 8004390

It is demonstrated that the analysis of the geothermal binary cycles is simplified through the use of basic thermodynamic relations. The complex interrelationships of thermodynamic, equipment, unit operational, and cost parameters are presented. It is shown that mixtures provide a significantly greater amount of work compared to pure fluids. Furthermore, mixture composition and behavior can be changed over the plant lifetime to match the changes in the geothermal resource. For fixed brine flow rate conditions, a decrease in the resource temperature results in a decrease in the net plant power. For the 300 F georesource temperature, the resource utilization and cost optima nearly coincide. Dissert. Abstr.

N80-18554*# Spectrolab, Inc., Sylmar, Calif.
DEVELOPMENT OF IMPROVED WRAPAROUND CONTACTS FOR SILICON Final Report
Jay W. Thornhill Dec. 1979 41 p
(Contract NAS3-20065)
(NASA-CR-159748) Avail: NTIS HC A03/MF A01 CSCL 10A

A developmental process for fabricating 2 X 4 cm back surface field silicon solar cells featuring wraparound contacts and screen printed dielectric isolation is described. The process was then used to fabricate a number of cells for evaluation and study, as well as to establish the validity of the process sequence. While a number of cells exhibiting relatively good conversion efficiencies were produced, nearly all had low I-V curve factors for the level of efficiencies attained. Cells with conversion efficiencies of more than 15 percent (air mass zero and 25 C) had fill factors of only 0.76. Evidence as to the cause of this has not been conclusive, but is most probably linked to isolation failure in the wraparound dielectric and associated shunting problems. Author

N80-18555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE FORMULATED PLASTIC SEPARATORS FOR ALKALINE BATTERIES Patent Application
D. W. Scheibley, J. M. Bozek, and D. G. Soltis, inventors (to NASA) Filed 28 Sep. 1979 10 p
(NASA-Case-LEW-12363-4; US-Patent-Appl-SN-079914) Avail: NTIS HC A02/MF A01 CSCL 10C

A flexible separator for alkaline batteries is disclosed. The separator is comprised of a coating which is applied to a nonwoven porous substrate such as sheets or mats of asbestos or other materials which are inert with respect to the alkaline electrolyte of the battery. The coating material comprises a polyphenylene oxide polymer, an organic additive and inorganic and organic fillers which comprise 55% by volume or less of the coating material. Preferably, at least one inorganic filler material which is reactive with the electrolyte is included to produce desirable pores in the coating. The organic additive is a polymeric polyester material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the coating. NASA

N80-18556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLEXIBLE FORMULATED PLASTIC SEPARATORS FOR ALKALINE BATTERIES Patent Application
D. W. Scheibley, J. M. Bozek, and D. G. Soltis, inventors (to

NASA) Filed 19 Jul. 1979 10 p
(NASA-Case-LEW-12363-3; US-Patent-Appl-SN-058658) Avail: NTIS HC A02/MF A01 CSCL 10C

A flexible separator for alkaline batteries is disclosed. The separator is comprised of a coating which is applied to a nonwoven porous substrate such as sheets or mats of asbestos or other materials which are inert with respect to the alkaline electrolyte of the battery. The coating material is comprised of a polyphenylene oxide polymer, an organic additive and inorganic, and organic fillers which comprise 55% by volume or less of the coating material. Preferably, at least one inorganic filler material which is reactive with the electrolyte is included to produce desirable pores in the coating. The organic additive is a polymeric polyester material which is hydrolyzed by the alkaline electrolyte to improve conductivity of the coating. NASA

N80-18557*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALYST SURFACES FOR THE CHROMOUS/CHROMIC REDOX COUPLE Patent Application
Jose D. Giner (Giner, Inc.) and Kathleen J. Cahill, inventors (to NASA) (Giner, Inc.) Filed 27 Jul. 1979 15 p Sponsored by NASA
(NASA-Case-Lew-13148-2; US-Patent-Appl-SN-061555) Avail: NTIS HC A02/MF A01 CSCL 10A

An electricity producing cell of the reduction-oxidation type is disclosed. The cell is divided into two compartments by a membrane and each compartment contains a solid inert electrode. A ferrous/ferric couple in a chloride solution serves as a cathode fluid which is circulated through one of the compartments to produce a positive electric potential disposed therein. A chromic/chromous couple in a chloride solution serves as an anode fluid which is circulated through the second compartment to produce a negative potential on an electrode disposed therein. The electrode is an electrically conductive, inert material plated with copper, silver or gold. A thin layer of lead plates onto the copper, silver or gold layer when the cell is being charged, the lead ions being available from lead chloride which has been added to the anode fluid. If the REDOX cell is then discharged, the current flows between the electrodes causing the lead to deplate from the negative electrode and the metal coating on the electrode will act as a catalyst to cause increased current density. NASA

N80-18558*# National Aeronautics and Space Administration, Washington, D. C.
CONTROL STRATEGY FOR A VARIABLE-SPEED WIND ENERGY CONVERSION SYSTEM
A. Jacob, D. Veillette, and V. Rajagopalan Nov. 1979 10 p refs Transl. into ENGLISH from Proc. of New York Inst. of Elec. Engineers Inc., 1978 p 528-531 In FRENCH Presented at Can. Commun. and Power Conf., Montreal, 18-20 Oct. 1978 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75512) Avail: NTIS HC A02/MF A01 CSCL 10A

A control concept for a variable-speed wind energy conversion system is proposed, for which a self-exited asynchronous cage generator is used along with a system of thyristor converters. The control loops are the following: (1) regulation of the entrainment speed as function of available mechanical energy by acting on the resistance couple of the asynchronous generator; (2) control of electric power delivered to the asynchronous machine, functioning as a motor, for start-up of the vertical axis wind converter; and (3) limitation of the slip value, and by consequence, of the induction currents in the presence of sudden variations of input parameters. Author

N80-18559*# Avco Corp., Wilmington, Mass.
PARAMETRIC STUDY OF POTENTIAL EARLY COMMERCIAL MHD POWER PLANTS Final Report
Finn A. Hals Dec. 1979 246 p refs
(Contracts DEN3-51; EF-77-A-01-2674)
(NASA-CR-159633; DOE/NASA/0051-79/1) Avail: NTIS HC A11/MF A01 CSCL 10B

Three different reference power plant configurations were considered with parametric variations of the various design parameters for each plant. Two of the reference plant designs were based on the use of high temperature regenerative air preheaters separately fired by a low Btu gas produced from a coal gasifier which was integrated with the power plant. The third reference plant design was based on the use of oxygen enriched combustion air preheated to a more moderate temperature in a tubular type metallic recuperative heat exchanger which is part of the bottoming plant heat recovery system. Comparative information was developed on plant performance and economics. The highest net plant efficiency of about 45 percent was attained by the reference plant design with the use of a high temperature air preheater separately fired with the advanced entrained bed gasifier. The use of oxygen enrichment of the combustion air yielded the lowest cost of generating electricity at a slightly lower plant efficiency. Both of these two reference plant designs are identified as potentially attractive for early MHD power plant applications. R.E.S.

N80-18560*# LinCom Corp., Pasadena, Calif.
A GROUND BASED PHASE CONTROL SYSTEM FOR THE SOLAR POWER SATELLITE. EXECUTIVE SUMMARY, VOLUME 1, PHASE 3 Final Report
C. M. Chie Jan. 1980 51 p refs
(Contract NAS9-15782)
(NASA-CR-160536; TR-0180-0779-Vol-1-Phase-3) Avail: NTIS HC A04/MF A01 CSCL 10B

The Solar Power Satellite (SPS) concept and the reference phase control system investigated in earlier efforts are reviewed. A summary overview of the analysis and selection of the pilot signal and power transponder design is presented along with the SOLARSIM program development and the simulated SPS phase control performance. Evaluations of the ground based phase control system as an alternate phase control concept are summarized. R.E.S.

N80-18561*# LinCom Corp., Pasadena, Calif.
SPS PILOT SIGNAL DESIGN AND POWER TRANSPONDER ANALYSIS, VOLUME 2, PHASE 3 Final Report
W. C. Lindsey, R. A. Scholtz, and C. M. Chie Jan. 1980 106 p refs
(Contract NAS9-15782)
(NASA-CR-160537; TR-0180-0779-Vol-2-Phase-3) Avail: NTIS HC A06/MF A01 CSCL 10B

The problem of pilot signal parameter optimization and the related problem of power transponder performance analysis for the Solar Power Satellite reference phase control system are addressed. Signal and interference models were established to enable specifications of the front end filters including both the notch filter and the antenna frequency response. A simulation program package was developed to be included in SOLARSIM to perform tradeoffs of system parameters based on minimizing the phase error for the pilot phase extraction. An analytical model that characterizes the overall power transponder operation was developed. From this model, the effects of different phase noise disturbance sources that contribute to phase variations at the output of the power transponders were studied and quantified. Results indicate that it is feasible to hold the antenna array phase error to less than one degree per power module for the type of disturbances modeled. R.E.S.

N80-18562*# Grumman Aerospace Corp., Bethpage, N.Y.
ACTIVE HEAT EXCHANGE SYSTEM DEVELOPMENT FOR LATENT HEAT THERMAL ENERGY STORAGE Topical Report, Jun. 1978 - Feb. 1979
Joseph Alario, Robert Kosson, and Robert Haslett Jan. 1980 73 p refs
(Contracts DEN3-39; EC-77-A-31-1034)
(NASA-CR-159726; DOE/NASA/0039-79/1;
GAC-TR-1681-09) Avail: NTIS HC A04/MF A01 CSCL 10A

Various active heat exchange concepts were identified from among three generic categories: scrapers, agitators/vibrators and slurries. The more practical ones were given a more detailed technical evaluation and an economic comparison with a passive tube-shell design for a reference application (300 MW sub t storage for 6 hours). Two concepts were selected for hardware development: (1) a direct contact heat exchanger in which molten salt droplets are injected into a cooler counterflowing stream of liquid metal carrier fluid, and (2) a rotating drum scraper in which molten salt is sprayed onto the circumference of a rotating drum, which contains the fluid salt is sprayed onto the circumference of a rotating drum, which contains the fluid heat sink in an internal annulus near the surface. A fixed scraper blade removes the solidified salt from the surface which was nickel plated to decrease adhesion forces. In addition to improving performance by providing a nearly constant transfer rate during discharge, these active heat exchanger concepts were estimated to cost at least 25% less than the passive tube-shell design. R.E.S.

N80-18563*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENGINEERING EVALUATION OF A SODIUM HYDROXIDE THERMAL ENERGY STORAGE MODULE Final Report

Donald G. Perdue and Larry H. Gordon Feb. 1980 22 p refs
(Contract EC-77-A-31-1034)
(NASA-TM-81417; DOE/NASA/1034-80/7; E-338) Avail: NTIS HC A02/MF A01 CSCL 10A

An engineering evaluation of thermal energy storage prototypes was performed in order to assess the development status of latent heat storage media. The testing and the evaluation of a prototype sodium hydroxide module is described. This module stored off-peak electrical energy as heat for later conversion to domestic hot water needs. R.E.S.

N80-18564*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OVERVIEW OF A STIRLING ENGINE TEST PROJECT

Jack G. Slaby 1980 27 p refs Proposed for presentation at 5th Intern. Automotive Propulsion Systems Symp., Dearborn, Mich., 14-18 Apr. 1980
(Contract EC-77-A-31-1040)
(NASA-TM-81442; DOE/NASA/1040-80/12; E-362) Avail: NTIS HC A03/MF A01 CSCL 10B

Tests were conducted on three Stirling engines ranging in size from 1.33 to 53 horsepower (1 to 40 kW). The tests were directed toward developing alternative, backup component concepts to improve engine efficiency and performance or to reduce costs. Some of the activities included investigating attractive concepts and materials for cooler-regenerator units, installing a jet impingement device on a Stirling engine to determine its potential for improved engine performance, and presenting performance maps for initial characterization of Stirling engines. The experiment results of the tests are presented along with predictions of results of future tests to be conducted on the Stirling engines. R.E.S.

N80-18565*# General Electric Co., Philadelphia, Pa. Space Div.

APPENDIX: MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT, VOLUME 2 Final Report

May 1979 425 p
(Contracts NAS3-20058; EX-77-A-29-1010)
(NASA-CR-159496; DOE/NASA/0058-79/2-Vol-2-App) Avail: NTIS HC A18/MF A01 CSCL 10B

The MOD-1 detail design is appended. The supporting analyses presented include a parametric system trade study, a verification of the computer codes used for rotor loads analysis, a metal blade study, and a definition of the design loads at each principal wind turbine generator interface for critical loading conditions. Shipping and assembly requirements, composite blade development, and electrical stability are also discussed. K.L.

N80-18566*# LinCom Corp., Pasadena, Calif.

ANALYTICAL SIMULATION OF SPS SYSTEM PERFORMANCE, VOLUME 3, PHASE 3 Final Report

A. V. Kantak and W. C. Lindsey Jan. 1980 91 p refs
(Contract NAS9-15782)
(NASA-CR-160538; TR-0180-0779-Vol-3-Phase-3) Avail: NTIS HC A05/MF A01 CSCL 10B

The simulation model for the Solar Power Satellite spaceantenna and the associated system imperfections are described. Overall power transfer efficiency, the key performance issue, is discussed as a function of the system imperfections. Other system performance measures discussed include average power pattern, mean beam gain reduction, and pointing error. R.E.S.

N80-18567# Naval Postgraduate School, Monterey, Calif.

SOLAR ENERGY DESIGN IMPROVEMENT: A METHODOLOGY FOR HYDRONIC FLATPLATE COLLECTOR SYSTEMS M.S. Thesis

Lawrence William Kozoyed Sep. 1979 236 p refs
(AD-A076836) Avail: NTIS HC A11/MF A01 CSCL 03/2

A methodology for solar energy system design improvement has been developed and coupled with a constrained function optimization code resulting in an automated solar energy system design procedure. The scope of the methodology is limited to systems using flat plate collectors and water as the working fluid. Eight parameters have been included as independent design variables. The design variables included collector area, collector tile angle, collector and storage fluid stream velocities, and collector to storage heat exchanger dimensions. The procedure includes an accounting for economic parameters as an intimate part of the design process. The resulting methodology has been used for the design of solar energy systems which would use shelf item collectors for the purpose of determining the optimum design variable vector for a given situation. The methodology could also be used on a limited basis for collector design optimization by exploring the effects of changing selected collector parmeters on system performance. The methodolgoy is coded in the FORTRAN computer language under the name SOLOAD-1 (Solar Energy Optimization Analysis or Design). GRA

N80-18568# SRI International Corp., Menlo Park, Calif.

A FEASIBILITY STUDY OF WINDPOWER FOR THE NEW ENGLAND AREA Final Report, 4 Jun. - 31 Oct. 1979

Patrick Martin, Michael Balma, Gwen Crooks, Roy Endlich, and Christopher Maxwell Oct. 1979 238 p refs
(Contract N00014-79-C-0539; SRI Proj. 8569)
(AD-A076614) Avail: NTIS HC A11/MF A01 CSCL 05/3

SRI International examined the applicability of large-scale windpower electricity generating systems (WEGS) as an alternative source of energy for the New England States in general and for the U.S. Navy Portsmouth Shipyard at Kittery, Maine, in particular. The Boeing Mod 2 wind machine was selected as representative of current technology in the appropriate size range of 2.5 megawatts (MW) rated capacity. Parametric economic analyses led to the conclusion that WEGS electricity can be at economic parity with the incremental electricity from conventional generators using oil or gas without any allowance for a capacity credit, provided that the annual utilization factor for the WEGS is at least 50%. Such utilization appears to be achievable at elevations between 620 and 1,240 m (2,000 and 3,000 ft). About one-eight of the 35,500 sq kilometers of air space reviewed in New Hampshire is at such elevations. Nonutility financing and capitalization can halve the costs of WEGS electricity. Nonutility ownership of WEGS is encouraged by recent state and federal legislation. The primary potential WEGS environmental impact, interference with television reception, can be mitigated by installation of cable TV service. GRA

N80-18569# Honeywell Power Sources Center, Horsham, Pa.

SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE CELLS Final Report, 25 Apr. - 27 Oct. 1978

L. J. Blagdon and B. Randall Ft. Monmonth, N.J. ERADCOM Nov. 1979 117 p refs
(Contract DAAB07-78-C-0530; DA Proj. 1F2-63702-DG-10)
(AD-A078961; DELET-TR-78-0530-F) Avail: NTIS HC A06/MF A01 CSCL 09/1

Hermetically sealed sulfur dioxide 'D' cells were fabricated and tested to improve safety during use/abuse conditions. Cathodes and anodes were optimized to yield efficient and safe operation at -20 F. Explosions were eliminated and venting was minimized when the cells were discharged at 2A constant current to 200% of the theoretical SO2 content between -20 F and +130 F. Discharge currents at 3.5A and above resulted in frequent but safe venting. GRA

N80-18570# American Univ., Washington, D. C.

THE PREPARATION OF SOME NOVEL ELECTROLYTES: SYNTHESIS OF PARTIALLY FLUORINATED ALKANESULFONIC ACIDS AS POTENTIAL FUEL CELL ELECTROLYTES Final Report

C. Bunyagidj, H. Pietrowska, and M. H. Aldridge Sep. 1979 77 p refs

(Contract DAAK70-77-C-0047; DA Proj. 1L1-61102-AH-51)
(AD-A078473) Avail: NTIS HC A05/MF A01 CSCL 10/2

The objective of this research was to prepare some strong acids for evaluation by Fort Belvoir as potential fuel cell electrolytes. The major acid, other than phosphoric, H3PO4, currently under investigation by Fort Belvoir as a fuel cell electrolyte is TFMSA, CF3SO3H.H2O, trifluoromethanesulfonic acid monohydrate aqueous solutions and sodium salt mixtures. TFMSA has been found to be superior to H3PO4 from the standpoint of electrode kinetics, but certain undesirable characteristics (volatility; wetting of Teflon) led to this research for a better fuel cell electrolyte. GRA

N80-18571# Naval Surface Weapons Center, White Oak, Md.
AROMATIC IONS AS ANODE MATERIALS FOR RECHARGEABLE, AMBIENT-TEMPERATURE BATTERIES Final Report
Stanley D. James Mar. 1979 28 p refs
(ZR0130101)
(AD-A078697; NSWC/TR-79-295) Avail: NTIS HC A03/MF A01 CSCL 10/3

The use of aromatic radical ions is proposed as anode material for high energy density, ambient-temperature and secondary batteries. Preliminary data are promising, showing that the naphthalenide anion can provide high current-densities at practical current-collectors like steel and nickel. However, the present test-electrode design did not confine naphthalene long enough to demonstrate rechargeability over a number of cycles. Two approaches are recommended to containing the aromatics close to a current-collector for extended periods of charge-discharge cycling. GRA

N80-18572# Eagle-Picher Industries, Inc., Colorado Springs, Colo.
HIGH RATE STABLE NICKEL-CADMIUM BATTERIES Final Report, Jun. 1975 - May 1979
James M. Hill Aug. 1979 69 p refs
(Contract DAAB07-75-C-1770)
(AD-A078714; DELET-TR-75-1770-F) Avail: NTIS HC A04/MF A01 CSCL 10/3

The report describes work for the design, construction, and testing of advanced state-of-the-art high rate stable vented nickel-cadmium batteries, with a special emphasis on the improvement of the separator wrap. Eagle-Picher Industries, Inc. designed and tested three to five cell units (BB-600 cells) of the BB-433 aircraft battery during phase I of this contract for the purpose of determining and selecting an optimum design. Phase II, the second half of the contract, included the design, fabrication and testing of 24 volt, 35 ampere-hour batteries of the BB-433 configuration, utilizing the optimum design features of Phase I. The batteries and the three to five cell units were tested in accordance with the updated Technical Guidelines for High Rate Stable Nickel-Cadmium Batteries. GRA

N80-18573# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
SAFETY STUDIES OF LITHIUM-SULFUR DIOXIDE CELLS Final Report, 11 May - 10 Dec. 1978
A. N. Dey and P. Witalis Nov. 1979 66 p refs
(Contract DAAB07-78-C-0535; DA Proj. 1F2-63702-D-610)
(AD-A077277; DELET-TR-78-0535-F) Avail: NTIS HC A04/MF A01 CSCL 10/3

The objective of this program was to study the relationship between the various design parameters of Li/SO2 cells and their abuse resistance for the purpose of developing approaches to the design of cells with an increased abuse resistance. The investigations were focussed on hermetically sealed D cells. Three factors were found to affect the abuse resistance of the cells significantly: (1) the Li/SO2 ratio, (2) the anode/cathode capacity ratio, and (3) the intrinsic rate capability of the cathode. Cells incorporating the most favorable combination of these factors were found to have a significantly greater abuse resistance than the standard production cells as determined by the behavior of the cells under constant current cell reversal at various discharge rates. The experimental work showed that for any particular cell design abusive conditions can be found that render the cells unsafe. It also showed that the abuse resistance of the cells can be even further increased by the development of truly high rate cathode structures and electrode configurations, so much so that in all probability the cells may be rendered safe under all conditions encountered in field use and storage. GRA

N80-18574# Mallory (P. R.) and Co., Inc., Burlington, Mass. Lab. for Physical Science.
ANALYSIS OF PRESSURE PRODUCING REACTIONS IN LITHIUM-SULFUR DIOXIDE CELLS Final Report, 15 Sep. 1977 - 31 Jul. 1979
A. N. Dey and R. W. Holmes Nov. 1979 139 p refs
(Contract DAAB07-77-C-0472; DA Proj. 1L1-62705-AH-94)
(AD-A077379; DELET-TR-77-0472-F) Avail: NTIS HC A07/MF A01 CSCL 10/3

Although the State-of-the-Art hermetically sealed high-rate D cells made by P. R. Mallory Co. Inc. are sufficiently abuse resistant for many applications, this program was initiated to explore the feasibility of improving the intrinsic abuse resistance of the system even further by chemical and/or mechanical means, so that the product may be rendered safe under all user conditions. The approach that was pursued involved: (1) the identification of the chemical reactions responsible for the pressure buildup and/or thermal runaway; (2) the determination of the sensitivity of these reactions to the various use and abuse variables; and (3) the development of methods to desensitize these reactions. GRA

N80-18575# Mallory (P. R.) and Co., Inc., Burlington, Mass.
LITHIUM-THIONYL CHLORIDE BATTERY Quarterly Report, 1 Apr. - 31 Jul. 1979
A. N. Dey, N. Hamilton, W. Bowden, and P. Witalis Nov. 1979 61 p refs
(Contract DAAB07-78-C-0563; DA Proj. 1L1-62705-AH-94)
(AD-A077162; DELET-TR-78-0563-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 10/3

The Li/SOCl2 inorganic electrolyte system is the highest energy density system known to date. It consists of a Li anode, a carbon cathode and SOCl2 which acts both as a solvent and as a cathode active material. The electrolyte salt that has been used most extensively is LiAlCl4, but salts such as Li2B10Cl10 and Li2O(AlCl3)2 have also been used successfully in this system for improving the shelf life characteristics. The main objective of this program is to develop high rate Li/SOCl2 cells and batteries for portable applications of the U.S. Army. The cells and batteries must deliver more high energy densities than are presently available and must be safe to handle under U.S. Army field conditions. GRA

N80-18576# Eagle-Picher Industries, Inc., Joplin, Mo. Electronics Div.
CALCIUM INORGANIC ELECTROLYTE BATTERY DEVELOPMENT Interim Report, Aug. 1977 - Jan. 1979
R. L. Higgins and L. Elliott Jun. 1979 82 p
(Contract F33615-77-C-2020; AF Proj. 3145)
(AD-A077685; AFAPL-TR-79-2044) Avail: NTIS HC A05/MF A01 CSCL 10/3

The objectives of this program are based on the desire to develop a calcium/oxyhalide system comparable to the lithium/oxyhalide system with respect to energy density and rate capabilities, while overcoming the problems of voltage delay and safety hazards. This project is directed toward assessing basic performance, safety, storage, and voltage delay of the calcium/oxyhalide system for use in Air Force applications. Early small cell development is designed for use in life support, rescue equipment, and spacecraft power, while Phase II development of large cells up to 10,000 Ampere hours is anticipated for use in missile standby and emergency ground power systems. Specific factors of concern in these applications are low volume, performance over a temperature range -40 F to 165 F, safety, and long shelf life. GRA

N80-18577# Air Force Academy, Colo.
OPTIMIZATION OF LiAl/NaAl-Cl SUB 4/CuCl SUB 2 THERMAL CELLS Technical Report, 2 Feb. - 21 Sep. 1979
Robert L. Vaughn Nov. 1979 24 p refs
(AF Proj. 2303)
(AD-A076945; FJSRL-TR-79-0011) Avail: NTIS HC A02/MF A01 CSCL 10/3

The optimization of LiAl/NaAlCl4/CuCl2 single thermal cells is presented. Energy densities were obtained over the temperature range 175-275 degrees C and current density range 15-150 mA/square centimeters. The results were compared to similar data for LiAl/NaAlCl4/MoCl5 and LiAl/NaAlCl4/FeCl3 cells. Although the CuCl2 type cell had a lower voltage than the other types, its energy density was higher due to the extended lifetimes of these cells. GRA

N80-18578# Bundesministerium fuer Wissenschaft und Forschung, Vienna (Austria). Sektion Forschung.
THE STORAGE OF ELECTROCHEMICAL ENERGY [ELEKTROCHEMISCHE ENERGIESPEICHERUNG: BESTANDSAUFNAHME NATIONALER UND INTERNATIONALER FORSCHUNGEN UND ENTWICKLUNGEN VON ELEKTROCHEMISCHEN ENERGIESPEICHERN]
Jan. 1976 77 p refs In GERMAN
Avail: NTIS HC A05/MF A01

A brief survey of national and international research is compiled. Progress is noted in electrochemical batteries, chemical electrolytes electric production, and fuel cells. Author (ESA)

N80-18579# Open Univ., Milton (England). Energy Research Group.
REPORT ON THE GAS SUPPLY INDUSTRY
G. Alexander, R. Armson, M. Barrett, D. Casper, P. Chapman, D. Crabbe, G. Gravelle, D. Hemming, D. Herd, S. Johnson et al Mar. 1979 212 p refs
(ERG-027) Avail: NTIS HC A10/MF A01; Secretary, Energy Res. Group, Milton Keynes, England

The evolution of the natural gas industry in the UK is reviewed, then an assessment of its operations in the foreseeable future is made. Its rapidly growing significance in the formulation of UK energy policy is emphasized, especially in regard to decisions in the development of nuclear energy. The impact on the UK coal industry is also shown and the relevance to planning for substitute natural gas production is pointed out. Pricing issues are covered as well. Supporting data presented include gas industry statistics on supply and demand, fuel price statistics, gas appliance statistics, and a load curve analysis used to foresee the possibility of a gas supply shortfall. Author (ESA)

N80-18580# National Technical Information Service, Springfield, Va.
SILVER CELLS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Diane M. Cavagnaro Dec. 1979 215 p
(PB80-802309) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Federally-funded research reports on silver cell primary and storage batteries with respect to electrochemistry, separators, hermetic seals, electrolytes, electrodes, charging, reliability, and applications are presented. The citations pertain mainly to silver zinc cells and to silver cadmium cells. This updated bibliography contains 207 abstracts, none of which are new entries to the previous edition. GRA

N80-18581# National Technical Information Service, Springfield, Va.
SILVER CELLS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 101 p Supersedes NTIS/PS-78/1191; NTIS/PS-77/1026; NTIS/PS-76/0879; NTIS/PS-75/649
(PB80-802317; NTIS/PS-78/1191; NTIS/PS-77/1026; NTIS/PS-76/0879; NTIS/PS-75/649) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

The cited reports from Federally-funded research relate to silver cell primary and storage batteries with respect to electrochemistry, separators, hermetic seals, electrolytes, electrodes, charging, reliability, and applications. Studies concerning silver zinc cells and silver cadmium cells are discussed in the majority of the abstracts. This updated bibliography contains 95 abstracts, 19 of which are new entries to the previous edition. GRA

N80-18582# National Technical Information Service, Springfield, Va.
SILVER CELLS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Nov. 1979
Diane M. Cavagnaro Dec. 1979 130 p Supersedes NTIS/PS-78/1192; NTIS/PS-77/1027; NTIS/PS-76/0880
(PB80-802325; NTIS/PS-78/1192; NTIS/PS-77/1027; NTIS/PS-76/0880) Avail: NTIS HC $30.00/MF $30.00 CSCL 10C

Citations from worldwide research on silver cell primary, storage, and solid state batteries are presented. Studies on electrochemistry, electrodes, electrolytes, separators, reliability, charging, and performance are covered. The use of these batteries in spacecraft, electric automobiles, and submersibles is discussed. This updated bibliography contains 124 abstracts, 20 of which are new entries to the previous edition. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-18583 North Carolina Univ. at Chapel Hill.
EVALUATION OF A PHOTOCHEMICAL SYSTEM FOR NITROGEN OXIDES CONTROL Ph.D. Thesis
John Randolph Richards 1979 199 p
Avail: Univ. Microfilms Order No. 8005069

The technical feasibility of a photochemical pretreatment system for NOx control at coal fired boilers was evaluated. This approach utilizes reaction mechanisms similar to those responsible for photochemical oxidant incidents. The reactions are initiated under controlled conditions while the pollutants are at high concentration and while the reaction products can be removed. Results indicate that under time limited and light limited conditions, it is possible to quench the photochemical reactions at the NO2 peak and prior to the formation of ozone, aerosols, and other secondary products. However, the photochemical system will not be commercially competitive unless serious operational problems limit the alternative techniques or unless the photochemical system can be refined to reduce cost. Dissert. Abstr.

N80-18584 Wisconsin Univ. - Madison.
ENSEMBLE TRAJECTORY ANALYSIS OF SUMMERTIME SULFATE AEROSOL CONCENTRATIONS IN THE NORTHEASTERN UNITED STATES Ph.D. Thesis
Perry James Samson 1979 164 p
Avail: Univ. Microfilms Order No. 7928667

A technique for quantifying the relationships between observed concentrations of atmospheric sulfate aerosol and their corresponding upstream history of sulfur dioxide emissions, wind speed, and mixing height is presented. Using reported sulfate concentrations from several sampling sites, 72 h upstream trajectories are computed for the mixed-layer of the atmosphere over the duration of their respective sampling periods. It is found that the sulfate concentrations were insensitive to upstream mixing height, highly correlated with the inverse of wind speed occurring at times greater than 24 h upstream of the sampling point, and totally in response to the spatial configuration of sources around the sampling point. The resultant sulfate concentrations were not always correlated with the total upstream emissions burdens of sulfur dioxide. The implications of these results to possible emission control strategies for sulfur dioxide to reduce the regional episodes of high sulfate concentrations are discussed and future work using this technique is outlined. Dissert. Abstr.

N80-18585 Commission of the European Communities, Luxembourg. Applied Mechanics Div.
ON THE FUTURE AVERAGE MERCURY CONTENT OF AIR, SOIL AND RIVER SEDIMENTS IN THE EUROPEAN ECONOMIC COMMUNITY AND IN THE WORLD'S OCEANS
R. H. vanEnk 1978 56 p refs
(EUR-6023; ISBN-92-825-0529-4; CD-NO-78-013-EN-C) Copyright. Avail: Issuing Activity

A computerized simulation of the pathways of mercury through the environment was used to estimate the average mercury concentration levels in the atmosphere, soil, and river sediments in the EEC as a function of time. In an extended model the impact of the total mercury released throughout the world on the average mercury content of ocean water as a function of time was investigated. It was shown that the tendency of the average mercury content levels to increase rapidly in the EEC is arrested. No significant increase of average mercury content of ocean water is expected. Author (ESA)

N80-18586*# ORI, Inc., Silver Spring, Md.
AERIAL APPLICATIONS DISPERSAL SYSTEMS CONTROL REQUIREMENTS STUDY Final Report
J. S. Bauchspies, W. L. Cleary, W. F. Rogers, W. Simpson, and G. S. Sanders 15 Feb. 1980 84 p refs
(Contract NAS3-21714)
(NASA-CR-159781; ORI-TR-1686) Avail: NTIS HC A05/MF A01 CSCL 13B

Performance deficiencies in aerial liquid and dry dispersal systems are identified. Five control system concepts are explored: (1) end of field on/off control; (2) manual control of particle size and application rate from the aircraft; (3) manual control of deposit rate on the field; (4) automatic alarm and shut-off control; and (5) fully automatic control. Operational aspects of the concepts and specifications for improved control configurations are discussed in detail. A research plan to provide the technology needed to develop the proposed improvements is presented along with a flight program to verify the benefits achieved. K.L.

N80-18587# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
CONTROL OF PARTICULATE EMISSIONS FROM TURBINE ENGINE TEST CELLS BY COOLING WATER INJECTION Final Report, Feb. - May 1979
Michael G. MacNaughton, James J. Tarquinio, and Joseph A. Martone Jul. 1979 77 p
(AF Proj. 1900)
(AD-A075947; AFESC/ESL/TR-79-19) Avail: NTIS HC A05/MF A01 CSCL 13/2

The operation of DOD turbine engine test cells in California has been criticized by the State environmental regulatory agencies because smoke generated by some engines results in excessive opacity (visibility) of the test cell exhaust plume. Since the plume exceeds visibility standards for only a relatively small proportion of engines tested a low cost control technique which brings the test cell into compliance with opacity standards is required. This study was initiated to verify that, in addition to forming a steam plume, water used to cool the test cell walls also removes engine generated particulates and substantiates this procedure as a legitimate pollution control technique. It can be concluded from this study that water injection as practiced at McClellan AFB test cell results in significant (approx. 50% by weight) control of turbine engine particulate emissions. It is postulated that the process could be made more efficient by the use of better designed spray nozzles which would increase water droplet particle contact and inclusion of a demister to increase water removal from the exhaust. GRA

N80-18588# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON MATERIALS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Report, 1971 - Sep. 1979
William E. Reed Dec. 1979 84 p
(PB80-801871) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

The bibliography contains selected research reports from worldwide literature on corrosion and damage by air pollution and includes studies on the effects upon steel, textiles, and building materials. Many studies cover a specific pollutant and its corrosive or damaging properties. This updated bibliography contains 78 abstracts, 9 of which are new entries to the previous edition. GRA

N80-18589# National Technical Information Service, Springfield, Va.
AIR POLLUTION EFFECTS ON MATERIALS. CITATIONS FROM THE NTIS DATA BASE Report,
William E. Reed Dec. 1979 159 p Supersedes NTIS/PS-78/1073; NTIS/PS-77/0912; NTIS/PS-76/0854; NTIS/PS-75/760; NTIS/PS-74/113
(PB80-801863; NTIS/PS-78/1073; NTIS/PS-77/0912; NTIS/PS-76/0854; NTIS/PS-75/760; NTIS/PS-74/113) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

The bibliography contains selected research reports on corrosion and damage by air pollution and includes studies on the effects upon steel, textiles, and building materials. Many studies cover a specific pollutant and its corrosive or damaging properties. This updated bibliography contains 151 abstracts, 27 of which are new entries to the previous edition. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-18590 Illinois Univ. at Urbana-Champaign.
RELATIONSHIP OF ACOUSTIC EMISSION AND ULTRASONIC VELOCITY TO DEFORMATION MECHANISMS AND DILATANCY DURING THE DUCTILE DEFORMATION OF MARBLE Ph.D. Thesis
Theodore Allen Koelsch 1979 128 p
Avail: Univ. Microfilms Order No. 8004208

The effects of confining pressure and grain size on both the macroscopic and microscopic deformational behavior of triaxially deformed marble were investigated by the simultaneous measurement of acoustic emissions, sample dilatancy and ultrasonic velocity changes. Numerical spectral analysis was carried out by digitizing individual events with a transient recorder. The axial compressional velocity changes were determined to within 0.01 percent from the transit time of 1 MHz signals. The analysis of the acoustic signals revealed two major types of signals distinguishable by their main frequency and waveform. The important microscopic processes identified were: (1) intracrystalline twinning, (2) grain boundary rotation and sliding, (3) microfracture nucleation, and (4) microfracture propagation. The importance of twinning as an effective mechanism for microfracture nucleation was demonstrated. Dissert. Abstr.

N80-18591 Colorado Univ. at Boulder.
THE NORTH PACIFIC OSCILLATION AND EIGENVECTORS OF NORTHERN HEMISPHERE ATMOSPHERIC CIRCULATION DURING WINTER Ph.D. Thesis
Jeffrey Charles Rogers 1979 186 p
Avail: Univ. Microfilms Order No. 8003010

A climatological study of the North Pacific Oscillation between 1906 and 1973, and a related analysis of the eigenvectors of Northern Hemisphere sea level pressure and 500 mb height departures for the winters 1946-47 through 1976-77 were performed. Two types of eigenvector analysis were carried out: the first was for mean winter pressure and height anomalies for the 31 winters and the second was for daily pressure and height departures during each individual winter. Eigenvector patterns based on daily data were compared between winters and also with the seasonal mean anomaly eigenvector patterns. Eigenvector patterns based upon unnormalized data appear to show real spatial variability in atmospheric anomaly fields whereas eigenvectors from normalized data are less useful. The associations between the time coefficients of the pressure and height eigenvector patterns are discussed. Dissert. Abstr.

N80-18592 New Mexico State Univ., University Park.
CONVECTION IN THE EARTH'S MANTLE DUE TO VISCOUS SHEAR AT THE CORE-MANTLE INTERFACE AND DUE TO LARGE SCALE BUOYANCY Ph.D. Thesis
Richard Guy Hills 1979 437 p
Avail: Univ. Microfilms Order No. 8002697

A three dimensional constant viscosity model for the mantle motions which are caused by viscous shear at the core mantle interface and by large scale buoyant forces is developed. The model utilizes geomagnetic data and magnetohydrodynamic theory to define an outermost core free stream velocity distribution. The resulting free stream velocity field is used in conjunction with the viscous boundary layer equations to find the corresponding stress field that the core exerts on the mantle. The resulting stress field acting on the inner mantle along with various passive outer boundary conditions are used to find the corresponding three dimensional velocity field of the mantle. To account for large scale buoyant forces, the model uses a currently available three dimensional seismic velocity anomaly distribution for the mantle along with simple linear models relating seismic velocity anomaly to density perturbation. Dissert. Abstr.

N80-18593 Texas Technological Univ., Lubbock.
COMPUTATION OF SYNTHETIC SEISMOGRAMS BY THE METHOD OF CHARACTERISTICS Ph.D. Thesis
Louis Reyes Castro 1979 65 p
Avail: Univ. Microfilms Order No. 8003211

The method of characteristics is applied to one-dimensional stress wave propagation problems of exploration interest. Several seismograms computed from dry, elastic, and viscoelastic near surface models are compared to data recorded by various types of receivers. The characteristics method is also used to obtain a solution to Biot's equations for wave propagation in saturated media. Synthetic seismograms are computed from various core and reservoir models saturated with different types of fluids. The computed seismograms are used to study the effect of variable reservoir conditions on a seismic wavelet. Dissert. Abstr.

N80-18594 Ohio State Univ., Columbus.
TROPOSPHERIC WATER VAPOR ABSORPTION IN THE INFRARED WINDOW REGIONS Ph.D. Thesis
Michael Eugene Thomas 1979 252 p
Avail: Univ. Microfilms Order No. 8001842

Attenuation of infrared radiation in the troposphere is dominated by water vapor absorption. Most past work on the spectroscopy of water vapor was on the analysis of the rotational and vibrational bands. As a result, a thorough listing of line positions, line strengths and halfwidths exists today. Because of the weak continuum absorption in the water vapor windows centered at 10 and 4 microns efforts to measure and model the continuum were as successful as efforts in the analysis of the bands. Yet a precise understanding of continuum absorption is important for long path energy transmission. The purpose of this study is to demonstrate the importance of far wing phenomena in characterizing H2O continuum absorption. A total line shape for water vapor-nitrogen interactions valid under tropospheric conditions is derived. The model is tested using a set of experimental room temperature H2O continuum measurements of high quality. Using this data base parameters of the far wing component of the total line shape are determined from near band experimental data. Dissert. Abstr.

N80-18595 Colorado Univ. at Boulder.
POSITIONS AND MOVEMENT OF VHF LIGHTNING SOURCES DETERMINED WITH MICROSECOND RESOLUTION BY INTERFEROMETRY Ph.D. Thesis
Craig Owen Hayenga 1979 222 p
Avail: Univ. Microfilms Order No. 8002981

The first positions and movement in azimuth and elevation of VHF lightning sources obtained with a 34 MHz swept lobe interferometer are presented. The positions are correlated in time with electric field measurements which provide identification of the various processes occurring during a lightning discharge. Data from several flashes are presented. The early or breakdown phase consists primarily of quasicontinuous VHF emission from a large number of linear sources moving rapidly approx. 10 to the 7th power m/s) over distances of approx. 100-1500 meters. The relative positions of these sources drift with a velocity approximately > 100,000 m/s. The temporal and spatial patterns of the observed 34 MHz radiation indicate that different processes generate VHF radiation than those that generate lower frequency lightning radio emission. The source of VHF lightning radiation is attributed to the acceleration of electrons in the small high field region at the tip of an advancing breakdown streamer. Dissert. Abstr.

N80-18596 Missouri Univ. - Columbia.
SPECTRAL ANALYSIS OF SYNOPTIC SCALE DISTURBANCES OVER THE MARSHALL ISLANDS REGION Ph.D. Thesis
Geoffrey Arthur Gordon 1979 121 p
Avail: Univ. Microfilms Order No. 8002364

A comprehensive spectral analysis of the Marshall Islands upper air data is presented. Upper air observations interpolated to a synoptic scale grid network are used in the analysis to examine the spatial variability of the spectral statistics. Variance spectra of geopotential height, virtual temperature, and specific volume are found to be dominated either by a diurnal component and/or by long period fluctuations. The average structure of the synoptic scale disturbances is determined from cross spectra between grid points and between levels in the vertical. The interstation coherences for the vertical motion are generally small. Cross spectra between the vertical and specific volume are used to estimate the eddy conversion of available potential energy to eddy kinetic energy. The low frequency components, periods greater than about 10 days, are largely responsible for the long term eddy conversion process. Dissert. Abstr.

N80-18597 Cornell Univ., Ithaca, N. Y.
ELECTRIC FIELDS IN THE LOW LATITUDE IONOSPHERE AND THEIR RELATIONSHIP TO MAGNETOSPHERIC AND INTERPLANETARY PHENOMENA Ph.D. Thesis
Gonzales Butron 1979 162 p
Avail: Univ. Microfilms Order No. 8003934

The low latitude extension of magnetospheric fields during magnetically disturbed periods was investigated through case studies of particular events. Simultaneous auroral and equatorial electric field data are used along with magnetic field data to study anomalous electric field patterns. During some substorms, accompanied by ring current activity, the worldwide equatorial zonal electric field component reversed from the normal pattern. In several cases the zonal equatorial electric field component was nearly identical in form to the zonal auroral component, indicating the close electrical coupling between these regions. Less certain, but equally intriguing, is the evidence presented for a close relationship between the zonal equatorial electric field and the time derivative of the ring current induced magnetic field. Dissert. Abstr.

N80-18598 Texas A&M Univ., College Station.
A STUDY OF THE VARIABILITY OF THUNDERSTORM ELECTRICAL EVENTS BASED ON VERY-LOW-FREQUENCY ELECTROMAGNETIC DATA Ph.D. Thesis
William Burns Freeman, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8003129

The incidence of lightning discharge was estimated including areal and global statistics and monthly values over a regularly spaced grid that includes much of the Eastern Hemisphere. It is shown that the Southern Hemisphere tropics were higher in average incidence of discharge than the Northern Hemisphere tropics. The relationship between flash density and thunderstorm days were studied for the months of January, April, August, and November with a curvilinear regression analysis. The relationship varied by season. The large-scale causes of the variability of cloud-to-ground discharges (dependent variable) were also studied. Multiple linear regression was used with and without a logarithmic transformation of the dependent variable. The variability of cloud-to-ground discharges when significant lightning had occurred was emphasized. Dissert. Abstr.

N80-18599# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOMAGNETIC MEASUREMENTS AT SAO JOSE DOS CAMPOS Progress Report, Dec. 1971 - Jan. 1975
J. M. daCosta, I. S. Batista, E. G. de Souza, and N. B. Trivedi Dec. 1979 190 p refs Revised
(INPE-1643-RPE/099-Rev) Avail: NTIS HC A09/MF A01

The total geomagnetic field intensity measurements are provided. Hourly mean values are given in the form of tables; computerized plots show the daily variations. Analysis of some important geomagnetic storms are also presented. The instrument used was an optical pumping rubidium vapor magnetometer. A brief explanation on the principle of operation of the magnetometer is also given. M.M.M.

N80-18600# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AIRGLOW STUDIES ON THE IONOSPHERE DYNAMICS OVER LOW LATITUDE IN BRAZIL
J. H. A. Sobral, M. A. Abdu, and I. S. Batista Dec. 1979 20 p refs Revised

(INPE-1644-RPE/100-Rev) Avail: NTIS HC A02/MF A01

Certain features are presented of the ionosphere dynamics over Cachoeira Paulista, Brazil, based on recent photometric observations of OI 6300 A emission, and ionosonde data, both taken at that site. The photometer scanned the geomagnetic meridional plane in a zenith angle range of 75 S to 75 N. Remarkable wavelike structures in the airglow intensity were observed in the premidnight period, which propagate from north to south (poleward) at an average speed of about 240 (+ or -) 70 m/s, assuming the emitting layer to be at an altitude of 250 km. These disturbances had wavelength of a few hundred kilometers and were associated with spread F echoes in the ionograms. A discussion is made on the possible source of the poleward propagating airglow disturbances. It is argued that these are possible manifestations of the vertical propagation of plasma bubbles over the magnetic equator. M.M.M.

N80-18601# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

IMPLICATION OF Z VARIATIONS DURING A NEAR-MOON EQUATORIAL COUNTERELECTROJET ON 6 MARCH 1967, IN THE INDIAN ZONE

R. P. Kane Nov. 1979 19 p refs Revised
(INPE-1613-RPE/087-Rev) Avail: NTIS HC A02/MF A01

The daily variations of geomagnetic H, D, Z were studied for the average of five internationally quiet days of March 1967, as also for a particular day (March 6, 1967), when a spectacular near-noon counterelectrojet occurred, at Trivandrum (about 30 km south of the dip equator) and Kodaikanal and Annamalainagar (about 170 km and 290 km north of dip equator) in the Indian zone. For the average quiet days, the electrojet seemed to be centered near dip equator in the morning, but shifted steadily southward over Trivandrum and beyond by evening. For the near-noon counterelectrojet day, single current systems flowing more than hundred kilometers to the north of the dip equator and/or double current systems, one normal near the dip equator and another reverse, about hundred kilometers or more to the north were indicated. Author

N80-18602# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ANALYSES OF THE MIDDLE LATITUDE INSTABILITIES USING A QUASI-GEOSTROPHIC MODEL [ANALISE DA INSTABILIDADE DOS DISTURBIOS DE ESCALA MEDIA, USANDO UM MODELO QUASE GEOSTROFICO]

Nelson de Jesus Ferreira and V. B. Rao Oct. 1979 38 p refs In PORTUGUESE; ENGLISH summary Presented at the 31st Reuniao Anual da SBPC
(INPE-1592-RPE/079) Avail: NTIS HC A03/MF A01

Effects of latent heat of condensation on middle latitude disturbances are discussed, using a two layer quasi-geostrophic model. The main characteristics of instabilities, vertical structure and energy transformations of unstable disturbances are analyzed, using the classical method of eigen values. Results showed that the inclusion of latent heat does not change significantly the conventional baroclinic instability, but generate another class of disturbances, the so-called medium-scale disturbances. These disturbances have a characteristic wave length of approximately 1000 km. Author

N80-18603# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A STUDY OF THE INFLUENCE OF OROGRAPHY AND DIFFERENTIAL ALBEDO ON THE ATMOSPHERIC CIRCULATION: AN APPLICATION TO THE BRAZILIAN NORTHEAST [UM ESTUDO SOBRE A INFLUENCIA DO ALBEDO DIFERENCIAL DA OROGRAFIA NA CIRCULACAO ATMOSFERICA: UMA APLICACAO PARA O NORDESTE BRASILEIRO]

Manoel Francisco Gomes Filho Nov. 1979 93 p refs In PORTUGUESE; ENGLISH summary
(INPE-1640-TDL/015) Avail: NTIS HC A05/MF A01

The influence of orography and differential albedo on the mean vertical motion in the atmosphere over Northeast Brazil was investigated. The vertical velocity is calculated at the top of the planetary boundary layer, using a vertically integrated atmospheric model, in which the zonal flow is laterally limited by rigid walls in the north and south, and vertically limited by a fixed lid. The mathematical model is similar to that of Berkofsky except that the equations are in the sigma coordinate system. The linearized equations are numerically resolved using a grid in which the variables are staggered in space and an Euler-backward time integration scheme. Considering the orography alone, sinking motions are induced over the region where the mean annual precipitation is a minimum. The same distribution of vertical motion results when the albedo alone is considered, which is in accord with the hypothesis of Charney. When both the orography and the albedo are incorporated in the model, the descending motion is found to be a greater intensity. As a result, it appears that the orography and the albedo together contribute to the low rainfall and arid conditions over Northeast Brazil. Author

N80-18604# Illinois Univ., Urbana. Aeronomy Lab.

WIND AND WAVE OBSERVATIONS IN THE MESOSPHERE USING COHERENT-SCATTER RADAR

I. D. Countryman and S. A. Bowhill 1 Oct. 1979 148 p
(Grant NSF ATM-77-06787)
(UILU-ENG-79-2508; ISSN-0568-0581; Aeronomy-89) Avail: NTIS HC A07/MF A01

Measurements of backscattered signals from the mesosphere using the coherent scatter technique were reviewed. The observations periods were four 48 hour intervals covering 1977. The multiheight, multidirectional wind measurements indicate that short period (1 minute to 1 hour) vertical velocity oscillations are usually evanescent vertically although propagating, reflected (trapped) modes are observed. Short period horizontal velocity oscillations were not consistently strong enough to be measurable for the pointing directions used. Tidal period horizontal winds were variable in amplitude and do not match theoretical predictions regarding uniform growth with height. R.C.T.

N80-18605*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

STUDY OF THE STORM TIME FLUXES OF HEAVY IONS Final Report

[1978] 42 p refs
(Contract NASw-3112)
(NASA-CR-162826; LMSC-D673774) Avail: NTIS HC A03/MF A01 CSCL 04A

The characteristics of the storm time ring current ions in the energy range of 0.5 to 16 keV were investigated. Data were processed and analyzed from the energetic ion mass spectrometer aboard the S3-3 satellite. Results are used for planning and operating the ion mass spectrometer experiment on the ISEE spacecraft, for selecting and processing the ISEE ion data, and for planning and conducting coordinated satellite experiments in support of the International Magnetospheric Study (IMS). It is established from the S3-3 ion data that relatively large fluxes of energetic (keV) O(+) and H(+) ions are frequently flowing upward from the ionosphere along magnetic field lines in the polar auroral regions. Also, from investigations with the same instrument during the main phase of three moderate (D sub ST approximately 100) magnetic storms, it is found that the number density of O(+) ions in the ring current was comparable to H(+) ion density the range 0.5 to 15 keV. J.M.S.

N80-18606*# Rockwell International Science Center, Thousand Oaks, Calif.

INTERNAL FRICTION AND MODULUS IN ROCKS AT DEPTH Annual Report, 1 Jan. - 31 Dec. 1979

B. R. Tittmann, V. A. Clark, and L. Anlberg Jan. 1980 5 p
(Contract NAS9-13846)
(NASA-CR-160476; SC577.86AR; AR-6) Avail: NTIS HC A02/MF A01 CSCL 08K

Experimental results relevant to the seismic wave attenuation observed for the lunar crust are presented along with some results bearing on the mechanism by which the presence of volatiles increases the attenuation. K.L.

N80-18607*# City Coll. of the City Univ. of New York. Dept. of Earth and Planetary Sciences.

SPHERICAL HARMONIC ANALYSIS OF A SYNOPTIC CLIMATOLOGY GENERATED WITH A GLOBAL GENERAL CIRCULATION MODEL

Zaphiris D. Christidis and J. Spar Feb. 1980 50 p refs
(Grant NGR-33-016-086)

(NASA-CR-162804) Avail: NTIS HC A03/MF A01 CSCL 04A

Spherical harmonic analysis was used to analyze the observed climatological (C) fields of temperature at 850 mb, geopotential height at 500 mb, and sea level pressure. The spherical harmonic method was also applied to the corresponding 'model climatological' fields (M) generated by a general circulation model, the 'GISS climate model.' The climate model was initialized with observed data for the first of December 1976 at 00. GMT and allowed to generate five years of meteorological history. Monthly means of the above fields for the five years were computed and subjected to spherical harmonic analysis. It was found from the comparison of the spectral components of both sets, M and C, that the climate model generated reasonable 500 mb geopotential heights. The model temperature field at 850 mb exhibited a generally correct structure. However, the meridional temperature gradient was overestimated and overheating of the continents was observed in summer. Author

N80-18608*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

NIGHTTIME/DAYTIME OPTICAL SURVEY OF LIGHTNING AND CONVECTIVE PHENOMENA EXPERIMENT (NOSL)

Bernard Vonnegut (State Univ. of New York at Albany), Otha H. Vaughan, Jr., and Marx Brook (New Mexico Inst. of Mining and Technology) Feb. 1980 27 p refs
(NASA-TM-78261) Avail: NTIS HC A03/MF A01 CSCL 04A

The Nighttime/Daytime Optical Survey of Lightning experiment was selected for flight on Orbital Flight Test 2 of the Space Shuttle. The background and rationale for the experiment are presented and the experiment hardware, the operating procedures, and the data analysis technique are discussed. Some preliminary results from the prototype hardware development are also presented. R.E.S.

N80-18609# Pennsylvania State Univ., University Park.

A HIGH SPEED DIGITAL AUTOCORRELATOR AND ITS APPLICATION TO MESOSPHERIC WATER VAPOR DETECTION

P. T. Petruno and John J. Olivero Jul. 1979 125 p refs
(Grant DAAG29-78-G-0083; DA Proj. 1L1-61102-B5-3A)
(AD-A076018; ERADCOM/ASL-CR-79-0083-1) Avail: NTIS HC A06/MF A01 CSCL 04/1

The emission and absorption spectrum of stratospheric and mesospheric water vapor are to be detected and analyzed. In both cases the method of detection requires a 22 GHz radiometer, and the data analysis requires a high speed, high resolution spectral analyzer. The basic radiometer fundamentals are discussed here, then the various techniques of spectral analysis are considered, which include both digital and analog versions of filter banks and autocorrelators. A prototype 2 x 1 bit digital autocorrelator was then designed and constructed. The system was designed to operate at a sampling rate of up to 100 MHz, with a resolution dependent on the number of autocorrelation points used. The system was then interfaced to a Nova 1200 minicomputer for data accumulation and transfer of data to nine track magnetic tape for standard processing. An IBM 370 computer system was available for final data reduction and analysis. The final system was a 16 point autocorrelator, two points of which were constructed. Future goals include completing the 16 points and using the system for a ground based measurement of upper atmosphere water vapor. GRA

N80-18610# Defence Research Establishment Valcartier (Quebec).

THE EFFECTS OF RELATIVE HUMIDITY ON ATMOSPHERIC AEROSOL EXTINCTION IN THE 3-5 MICROMETERS AND 8-15 MICROMETERS SPECTRAL REGIONS

W. G. Tam and C. Boily May 1979 26 p refs
(AD-A070159; DREV-R-4121/79) Avail: NTIS HC A03/MF A01 CSCL 04/1

The variation of the infrared aerosol extinction coefficient as a function of relative humidity is studied. This is based on a two component particle distribution model. The aerosol extinction coefficient increases by a factor of more than 10 throughout the 3-5 and 8-15 micrometers spectral regions as the relative humidity increases from 0.5 to 0.99. For high relative humidities, a region of lower extinction around 10-11 micrometers is noticed. GRA

N80-18611*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

A CORRELATION BETWEEN AURORAL KILOMETRIC RADIATION AND FIELD-ALIGNED CURRENTS Progress Report

James Lauer Green, Nicolaos A. Saflekos, Donald A. Gurnett, and Thomas A. Potemra May 1979 34 p refs Prepared in cooperation with APL, Johns Hopkins Univ., Laurel, Md.
(Contract NAS1-13129; Grant NGL-16-001-043; Contracts N00014-76-C-0016; N00017-72-C-4401)
(NASA-CR-162842; AD-A076413; Rept.-79-35) Avail: NTIS HC A03/MF A01 CSCL 04/1

Simultaneous observations of field-aligned currents (FAC) and auroral kilometric radiation (AKR) are compared from the polar orbiting satellites Triad and Hawkeye. The Triad observations were restricted to the evening-to-midnight local time sector (19 to 01 hours magnetic local time) in the northern hemisphere. This is the region where it is believed the most intense storms of AKR originate. The Hawkeye observations were restricted to when the satellite was in the AKR 'emission cone' in the Northern Hemisphere and at radial distances > or = 7 R(E) (Earth radii) to avoid local propagation cutoff effects. A (R/7 R(E)2 normalization to the power flux measurements of the kilometric radiation from Hawkeye is used to take into account the radial dependence of this radiation and to scale all intensity measurements such that they are independent of Hawkeye's position in the emission cone. Integrated field-aligned current intensities from Triad are determined from the observed transverse magnetic field disturbances. Statistically, there is a good correlation between the AKR intensity and the integrated current sheet intensity of field-aligned currents. It is found that as the intensity of auroral kilometric radiation increases so does the integrated auroral zone current sheet intensity increase. GRA

N80-18612# Naval Research Lab., Washington, D. C.

THE NRL CHMAIR CODE: A DISTURBED SEA LEVEL AIR CHEMISTRY CODE Interim Report

R. F. Fernsler, A. W. Ali, J. R. Greig, and I. M. Vitkovitsky 15 Nov. 1979 41 p refs
(AD-A077667; NRL-MR-4110) Avail: NTIS HC A03/MF A01 CSCL 04/1

An Air Chemistry Code which describes the evolution and the relaxation of disturbed air at the sea level is described. Pertinent reactions and their coefficients are presented. The Code can be utilized with various forms of energy inputs, i.e., high power lasers, microwave radiation, electric discharge and high energy electron and proton beams. GRA

N80-18613# Naval Research Lab., Washington, D. C.

COMPUTER SIMULATION OF GRADIENT DRIFT INSTABILITY PROCESSES IN OPERATION AVEFRIA

B. E. McDonald, M. J. Keskinen, S. L. Ossakow, and S. T. Zalesak 15 Nov. 1979 38 p refs
(AD-A077668; NRL-MR-4112) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerically equations of motion are solved for the evolution of a one level, two dimensional F region ionospheric plasma cloud with five different ratios of cloud to background integrated Pedersen conductivity. The simulations show that (1) physically small clouds striate due to the gradient drift instability more rapidly than large clouds, and (2) there exists a minimum striation onset time as a function of the Pedersen conductivity ratio. Observation (1) is in agreement with the rapid striation development exhibited by the physically small Avefria barium cloud releases, relative to the large Secede or STRESS type releases. Author (GRA)

N80-18614# Colorado Univ., Boulder.

CHARGED ATMOSPHERIC CONGLOMERATES ROLE OF NEGATIVE IONS IN HETEROMOLECULAR NUCLEATION THE PROPERTIES OF SMALL CLUSTERS AND ATMOSPHERIC IONS Final Report, 10 Jun. 1976 - 1 Jul. 1979

A. W. Castleman, Jr. 1 Jul. 1979 34 p refs
(Grant DAAG29-76-G-0276)
(AD-A078962; ARO-14191.8-CX) Avail: NTIS

HC A03/MF A01 CSCL 04/1

There has been an enormous growth of interest in the properties of small particles and in the mechanisms by which they are formed. The research program undertaken in our laboratory was directed to a study of the fundamentals of nucleation about negative ions, with particular attention to an elucidation of the structure of small clusters, and the role of chemical bonding in establishing their stability. Using a new high pressure mass spectrometric technique, a systematic investigation of the bond energies and entropies of numerous ligand-negative ion complexes were determined. Concurrent theoretical work on the bonding of small complexes and ion-induced nucleation was also undertaken. The results have led to a more complete understanding of nucleation phenomena, and especially of the importance of cluster structure in the development of surfaces and in effecting phase transformations. In addition, the work has led to a clarification of some recent atmospheric observations reported in the literature. Author (GRA)

N80-18615# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ALTAIR OBSERVATIONS OF IONOSPHERIC IRREGULARITIES AND BACKGROUND DENSITIES
David M. Towle 19 Sep. 1979 68 p refs
(Contract F19628-78-C-0002)
(AD-A078599; TN-1979-41; ESD-TR-79-223) Avail: NTIS
HC A04/MF A01 CSCL 04/1

A series of measurements of the properties of equatorial ionospheric irregularities were made at Kwajalein, M.I. in August 1977 and July-August 1978. These measurements, involved coordinated ground based and in-situ sensors. The ARPA Long-range Tracking and Instrumentation Radar (ALTAIR), obtained backscatter and transmission data during five nights in August 1977 and eight nights in July-August 1978. This report describes the ALTAIR data from the night of 11 August 1978 which yield direct quantitative measurements of 1 m and 3/8 m irregularities and of plasma depleted regions. These plasma depleted regions, previously predicted on the basis of theoretical speculation and in-situ data, appear to be associated with the decay phase and not the generative phase of the field aligned irregularities. GRA

N80-18616# Utah State Univ., Logan. Space Measurement Lab.
ROCKETBORNE IONOSPHERIC STUDIES Final Report, 28 May 1976 - 30 Sep. 1979
D. A. Burt and G. D. Allred 6 Aug. 1979 144 p refs
(Contract F19628-76-C-0261)
(AD-A078799; AFGL-TR-79-0179) Avail: NTIS
HC A07/MF A01 CSCL 04/1

Eight instrumented sounding rockets were flown to investigate ionospheric parameters and to further the development of new instruments and measurements techniques for investigating such parameters. Particular emphasis has been placed upon development of instrumentation for electron dosing via large electron accelerators aboard the payloads and assessment of the effects of such dosing as manifested by ultraviolet, visible, and particularly, infrared emissions. Launches have been accomplished under a variety of ionospheric conditions ranging from the quiescent, undisturbed ionosphere through intense auroral conditions. This report describes the program of launches and instrumentation used to accomplish the measurements. GRA

N80-18617# Southwest Research Inst., San Antonio, Tex.
LIGHTNING TRACKING SYSTEM EVALUATION Progress Report, 1 May - 13 Jul. 1979
R. L. Johnson 22 Aug. 1979 6 p
(Contract N00014-79-C-0223)
(AD-A078722) Avail: NTIS HC A02/MF A01 CSCL 04/1

This is a progress report summarizing technical progress on (1) verification of performance of the lightning position and tracking system (LPATS) developed by Atlantic Science Corporation, and (2) a side-by-side performance comparison of the LPATS device with the lightning location system developed by Lightning Location and Protection Incorporated (LLP). GRA

N80-18618# Naval Research Lab., Washington, D. C.
PRELIMINARY NUMERICAL STUDY OF THE OUTER SCALE SIZE OF IONOSPHERIC PLASMA CLOUD STRIATIONS
M. J. Keskinen, B. E. McDonald, and S. L. Ossakow 3 Dec. 1979 27 p refs
(AD-A078492; NRL-MR-4124) Avail: NTIS
HC A03/MF A01 CSCL 04/1

The one level, two-dimensional fluid equations modelling striation development in large F region ionospheric plasma clouds have been numerically solved, using an initial one-dimensional cloud geometry, for three different initial Pedersen conductivity gradient scale lengths L = 3, 6, 10 km. In the nonlinear regime evidence is presented for an outer scale size of well developed striations in a direction (y) perpendicular to the ExB drift (x) of the plasma cloud whose initial Pedersen conductivity varies only along the drift direction. GRA

N80-18619# Naval Research Lab., Washington, D. C.
A COHERENT NONLINEAR THEORY OF AURORAL KILOMETRIC RADIATION
Crockett L. Grabbe, P. Palmadesso, and K. Papadopoulos Oct. 1979 37 p refs
(RR0330242)
(AD-A078918; AD-E000342; NRL-MR-4087) Avail: NTIS
HC A03/MF A01 CSCL 04/1

A theory of auroral kilometric radiation due to the nonlinear interaction between negative energy electromagnetic waves and coherent EIC waves is developed. The theory predicts that such radiation produced must have X-mode polarization and must have a frequency just slightly below the Doppler-shifted beam cyclotron frequencies. The basic requirement for free space accessibility is the presence of high-energy beams and a density cavity of the type observed by Isis I measurements. It is predicted that a harmonic band structure in the kilometric radiation may be observable. GRA

N80-18620# Air Force Geophysics Lab., Hanscom AFB, Mass.
SATELLITE ATMOSPHERIC RADIANCE MEASUREMENTS IN THE VACUUM ULTRAVIOLET
R. F. Huffman, F. J. LeBlanc, J. C. Larrabee, and D. E. Paulsen Jul. 1979 44 p refs
(AF Proj. 6690)
(AD-A078628; AFGL-TR-79-0151; AFGL-ERP-665) Avail: NTIS HC A03/MF A01 CSCL 04/1

A satellite experiment has obtained nadir-viewing atmospheric radiance measurements in the 1100 to 2900 angstrom wavelength region from the polar orbiting satellite S3-4. This report describes the instrumentation, measurement techniques, and initial results. The observed emission is from airglow, solar scatter, and auroral regions. Spectral and spatial measurements previously unavailable have been made for the nitrogen Lyman-Birge-Hopfield emission, vacuum ultraviolet aurora, hydrogen geocorona, tropical ultraviolet airglow, twilight fluorescence nitric oxide spectrum, and night oxygen Herzberg band emission. Low values of the day and night background radiance values have been found; these values can be applied to improved missile detection techniques. Spatial resolution down to about one kilometer will enable possible variability to be sought. Observations were made in the period March to September 1978. Correlations with other geophysical factors such as solar flux, magnetic index, and seasonal variations will be made after the data base from the experiment is completed. GRA

N80-18621# Air Force Geophysics Lab., Hanscom AFB, Mass.
ABSORPTION DATA ANALYSIS FOR EUVS EXPERIMENT OF THE SATELLITES AE-C, D AND E
Les M. Chaikin and Katsura Fukui Aug. 1979 48 p refs
(AF Proj. 6690)
(AD-A078663; AFGL-TR-79-0191; AFGL-ERP-672) Avail: NTIS HC A03/MF A01 CSCL 04/1

One of the two tasks that the Extreme Ultraviolet Spectrophotometers (EUVS) onboard the Atmosphere Explorer Satellites perform is absorption analysis of the thermosphere. The optical depth is derived from observations during parts of orbits including conditions of nearly negligible attenuation as reference. Details of two different approaches are described. The first one, used by the program LMC80, deals with certain standard optical depths only; the second one, used by the program LMC85, deals with time-ordered records of optical depths for input-controlled fixed steps in time. GRA

N80-18622# Science Applications, Inc., La Jolla, Calif.
H2O-N2 TRANSITION RATES AND LINE SHIFTS OF WATER VAPOR Final Report
J. Nagel and D. Rogovin Kirtland AFB, New Mexico AFWL Jul. 1979 131 p refs
(Contract F29601-77-C-0039; AF Proj. 317J)
(AD-A078394; AD-E200395; AFWL-TR-79-3) Avail: NTIS HC A07/MF A01 CSCL 04/1

The VV deactivation rate of N2 by H2O is calculated using a hard core repulsive potential. The process is found to be dominated by near resonant VR processes with large changes in rotational motion, and the rate is critically dependent on the classical path chosen. In part 2, a nonperturbative model of H2O is used to calculate the effects of centrifugal distortion on absorption line intensities. The errors are less than 10 percent for weak as well as strong lines. The effects of collision broadening by N2 and O2 are presented using Anderson theory together with dipole transitions by the multimode model. GRA

N80-18623# Smithsonian Astrophysical Observatory, Cambridge, Mass.
GLOBAL FREQUENCY DISTRIBUTION OF EXOSPHERIC TEMPERATURE
Jack W. Slowey Jul. 1979 25 p refs
(Contract F19628-78-C-0126; AF Proj. 6690)
(AD-A077293; AFGL-TR-79-0143; SCIENTIFIC-1) Avail: NTIS HC A02/MF A01 CSCL 04/1

The distribution of exospheric temperature under all conditions of solar and geomagnetic activity and of spatial location was determined for two different models of the Earth's thermosphere and exosphere. The two models were the 1971 Jacchia model and the U.S. Standard Atmosphere Supplements, 1966. Data from the past 12 solar cycles were used to determine the contribution of solar activity to the distributions. The contribution of geomagnetic activity was based on the distribution of geomagnetic activity for solar cycle 20. The spatial contribution was determined by analysis of the diurnal variation in exospheric temperature as given by the particular model. The resulting distributions indicate a mean exospheric temperature of approximately 900 K for either model. GRA

N80-18624# Photometrics, Inc., Lexington, Mass.
AIRCRAFT PROGRAM FOR TARGET BACKGROUND, AND SKY RADIANCE MEASUREMENTS
Randall B. Sluder, W. Scott Andrus, and Irving L. Kofsky 15 Jun. 1979 28 p refs
(Contract F19629-77-C-0168; ARPA Order 2656)
(AD-A076959; PHM-01-79; SCIENTIFIC-2; AFGL-TR-79-0139) Avail: NTIS HC A03/MF A01 CSCL 17/8

A review of PhotoMetrics: field and data reduction work for the Air Force Geophysics Laboratory in the DNA-sponsored nuclear effects simulations program and the ARPA-sponsored targets and backgrounds measurements program during the period April 1978-April 1979 is presented. Data flights of USAF NKC-135 53120 on which PhotoMetrics operated radiometric instruments, the design, fabrication and application of an optical co-aligner for very narrow-angle aircraft instruments are documented, and modifications to an ISIT vidicon camera for auroral imaging are reviewed. GRA

***N80-18625#** Royal Netherlands Meteorological Inst., De Bilt.*
TIDE FORECASTING ACCURACY [VERGELIJKING VAN VERWACHTE EN OPGETREDEN WATERSTANDEN]
J. J. Hoogstrate 1979 15 p ref In DUTCH
(KNMI-V-320) Avail: NTIS HC A02/MF A01

Forecast data on high tide prepared for the Dutch coast were compared with real data to determine the effect length of forecast period on accuracy. Data for high tides were analyzed at Hoek van Holland and Flushing, for 0800 and 1500 hours covering a two year period. Charts are presented showing the deviations from predicted heights. Author (ESA)

N80-18626# Stockholm Univ. (Sweden). Dept. of Meteorology.
CALIBRATION OF AN ULTRAVIOLET POLYCHROMATOR FOR ROCKETBORNE STUDIES OF AURORA
Margareta Malmort 8 Jan. 1979 53 p refs In SWEDISH; *ENGLISH summary Prepared in Cooperation with International* Meteorological Inst., Stockholm
(AP-19) Avail: NTIS HC A04/MF A01

A multichannel fixed wavelength spectrometer, i.e., polychromator, for the spectral interval 200 to 400 nm, was designed, constructed, and calibrated. The instrument is for the study of nitric oxide chemistry in an auroral arc illuminated by the Sun. The instrument is part of the rocket payload S-27 TWILIGHT. Emission features are observed on two channels, one fitted with a quartz cell containing NO, the other with an argon filled reference cell. The purpose is to obtain specifically high spectral selection for NO emissions. All channels have a bandwidth of roughly 4 nm and a sensitivity of about 10 counts/Rayleigh. The calibration procedure is presented together with the purpose of the experiment and a brief physical description of some relevant processes involved in auroral NO chemistry. Author (ESA)

N80-18070*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TROPOSPHERIC PATH LENGTH FLUCTUATION IN TEMPERATE SEMIARID LOCALES: APPLICATION TO THE GRAVITATIONAL WAVE DETECTION EXPERIMENT
A. L. Berman and S. D. Slobin *In its* The Deep Space Network 15 Feb. 1980 p 79-85 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 04A

N80-18466*# Ceskoslovenska Akademie Ved, Prague. Geophysical Inst.
A METHOD OF PREDICTIONS GEOMAGNETIC ACTIVITY BASED ON A CORONAL MODEL OF RELATIONS BETWEEN SOLAR AND GEOMAGNETIC ACTIVITIES
Jaroslav Halenka *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 44-60 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18467*# Polish Academy of Sciences, Warsaw. Space Research Centre.
KAZIA: A COMPUTER SYSTEM FOR SOLAR-TERRESTRIAL DATA PROCESSING AND OBJECTIVE PREDICTION
K. Stasiewicz, M. Maksymienko, and M. Jakimiec (Wroclaw Univ.) *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 61-66 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18471*# Institute of Applied Geophysics, Moscow (USSR).
FORECASTING IONOSPHERIC AND GEOMAGNETIC CONDITIONS AT THE IAG FORECASTING CENTER
S. I. Avdyushin, A. D. Danilov, A. B. Malyshev, G. N. Novikova, and P. M. Svidsky *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 104-117 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

***N80-18473*#** National Physical Lab., New Delhi (India).*
A SIMPLIFIED INDEXING OF F-REGION GEOPHYSICAL NOISE AT LOW LATITUDES
S. Aggarwal, D. R. Lakshmi, and B. M. Reddy In NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 134-139 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18482*# *Ionospheric Prediction Service, Darlinghurst* (Australia). Dept. of Science and the Environment.
A REVIEW OF THE OPERATION OF THE IUWDS REGIONAL WARNING CENTRE AT THE IONOSPHERIC PREDICTION SERVICE, SYDNEY
F. E. Cook and P. Davies *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 229-238 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18483*# *Ionospheric Prediction Service, Darlinghurst* (Australia). Dept. of Science and the Environment.
A DISTURBANCE FORECASTER'S VIEW OF THE SEPTEMBER 1977 EVENTS

F. E. Cook *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 239-248 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18484*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
THE USE OF IONOSPHERIC INDICES TO MAKE REAL- AND NEAR-REAL-TIME FORECASTS OF foF2 AROUND AUSTRALIA
L. F. McNamara *In* NOAA Solar-Terrest. Prediction Proc., Vol. 1 Aug. 1979 p 249-258 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18485*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
PREDICTION LIMITS FOR foF2
P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 259-278 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18486*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
A WEEKLY IONOSPHERIC INDEX
J. F. Turner and P. J. Wilkinson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 279-287 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18489*# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
PREDICTIONS OF THE SPACE ENVIRONMENT SERVICES CENTER
G. R. Heckman *In its* Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 322-349 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18490*# Air Force Global Weather Central, Offutt AFB, Nebraska.
GEOPHYSICAL FORECASTING AT AFGWC
Richard L. Thompson and James A. Secan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 350-366 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18491*# Air Force Global Weather Central, Offutt AFB, Nebraska.
IONOSPHERIC MODELING AT AIR FORCE GLOBAL WEATHER CENTRAL
Thomas F. Tascione, Thomas W. Flattery, Vernon G. Patterson, James A. Secan, and James W. Taylor, Jr. *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 367-377 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

N80-18494*# Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
FORECASTS OF GEOMAGNETIC ACTIVITY BY OTTAWA MAGNETIC OBSERVATORY: THEIR RELIABILTY AND APPLICATION
J. Hruska *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 398-405 refs Sponsored in part by NOAA (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-18627 Oklahoma Univ., Norman.
THE ENERGY BUDGETS OF A DEVELOPING CYCLONE OVER THE EAST CHINA SEA DURING THE 1975 AIR MASS TRANSFORMATION EXPERIMENT Ph.D. Thesis
Ming-Ying Wei 1979 148 p
Avail: Univ. Microfilms Order No. 8003805

The available potential and kinetic energy budgets are evaluated for a developing cyclone over the East China Sea during the 1975 air mass transformation experiment. The computations are made in a quasi Lagrangian frame. The relationship between the cyclone development and the amount of energy supplied from the ocean during air mass modification is examined. Three components of the diabatic processes are considered. Both the stable and convective latent heat release are estimated; the latter is accomplished using Kuo's cumulus parameterization scheme. The sensible heat transferred from the ocean is computed by employing the bulk aerodynamic method. The radiational heating is estimated considering modeled cloud distributions. Dissert. Abstr.

N80-18628 Colorado Univ. at Boulder.
TEMPERATURE AND CIRCULATION ANOMALIES IN THE EASTERN CANADIAN ARCTIC, SUMMER 1946 - 1976 Ph.D. Thesis
Richard Alan Keen 1979 170 p
Avail: Univ. Microfilms Order No. 8002991

Baffin Island and nearby regions of the eastern Canadian Arctic have been the focus of many recent and ongoing paleoclimetic and glaciological studies. The region is very suitable for these studies because of the sensitivity of regional ice and snow conditions to small changes in summer temperature (which average a few degrees above freezing). Baffin Island's location beneath one of the major features of the general atmospheric circulation, a trough in the upper westerlies, raises the possibility that regional climate variations may be closely linked to changes in the global-scale climate and circulation. The existence of such a link would greatly enhance the importance of Baffin Island paleoclimatic and glaciological studies. The thirty summers (1946-76) of surface temperature and pressure, and upper air data for the Baffin region, the Arctic, and the extratropical Northern Hemisphere, are analyzed to establish the nature and significance of the regional global summer climate and circulation links. Dissert. Abstr.

N80-18629 Cornell Univ., Ithaca, N. Y.
NUMERICAL MODELING OF HIGH LATITUDE WINDS IN THE UPPER ATMOSPHERE Ph.D. Thesis
Antonio Eduardo Pereira 1979 98 p
Avail: Univ. Microfilms Order No. 8003974

The upper atmospheric electrically driven wind system was modeled to reproduce the characteristics of rocket measurements made in the afternoon auroral over Fairbanks. The plasma density and electric field in a geostationary frame of reference were obtained from the incoherent scatter radar station at Chatanika, Alaska. The model consists of the meteorological equations to which viscosity and forcing terms of electrical origin were added. The equations can be solved numerically by treating the advection terms with the Lax-Wendroff method and the viscous terms by a fully implicit method. The continuity equation does not need to be solved simultaneously with the momentum and energy equations. The dispersion associated with the Lax-Wendroff method can be controlled by using a grid spacing small in relation to the length scale for large changes in the electric field, plasma density, and other parameters. Dissert. Abstr.

N80-18630 Texas A&M Univ., College Station.
THUNDERSTORM-ENVIRONMENT INTERACTIONS DETERMINED WITH THREE-DIMENSIONAL TRAJECTORIES Ph.D. Thesis
Gregory Sims Wilson 1979 166 p
Avail: Univ. Microfilms Order No. 8003197

Diagnostically determined three dimensional trajectories were used to reveal some of the scale interaction processes that occur between convective storms and their environment. Convective storm systems with good temporal and spatial continuity are shown to be related to the development and movement of short wave circulation systems aloft that propagate eastward within a zonal mid tropospheric wind pattern. These short wave systems are found to produce the potential instability and dynamic triggering needed for thunderstorm formation. The environmental flow patterns, relative to convective storm systems, are shown to produce large upward air parcel movements in excess of

50 mb/3h in the immediate vicinity of the storms. The thermo- and hydrodynamical processes that lead to changes in atmospheric structure before, during, and after convective storm formation are successfully described using total time derivatives of pressure or net vertical displacement (NVD), potential temperature, and vector wind calculated by following air parcels. The high degree of scale interaction between synoptic and convective scale systems is demonstrated statistically, using multiple linear regression, by combining NVD's and static stability measurements to successfully locate convective activity of various intensities over the AVE IV network. Dissert. Abstr.

N80-18631 World Meteorological Organization, Geneva (Switzerland).

WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM - SATELLITE SUB-SYSTEM. INFORMATION ON THE APPLICATION OF METEOROLOGICAL SATELLITE DATA IN ROUTINE OPERATIONS AND RESEARCH: ABSTRACTS, ANNUAL SUMMARIES AND BIBLIOGRAPHIES

1978 198 p refs
(WMO-475-Suppl-2) Avail: NTIS HC A09

Contributions from countries participating in the World Weather Watch program are listed. Emphasis is on the Global Observing System: Satellite sub-system. Bibliographic information and an abstract of each contribution are provided. Author (ESA)

N80-18632# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.

HIGH-INTENSITY RAINFALL STATISTICS FOR CANADA

B. Segal Nov. 1979 130 p refs
(CRC-1329-E) Avail: NTIS HC A07/MF A01

Rainfall data for Canada are presented, and the potentially detrimental influence of the rainfall on microwave transmission is studied. The rainfall statistics across the entire country are examined and discussed in relation to the design and operation of radio and radar systems. The precipitation data base is reviewed including rain gauge calibration, rain gauge errors, and rain chart misalignment. The rainfall inhomogeneity and the temporal variability are discussed and precipitation modifying influences such as terrain effects and anthropogenic effects are reported. A.W.H.

N80-18633# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE RELATIONSHIP BETWEEN TOTAL PRECIPITABLE WATER AND SURFACE DEW POINT

Y. Viswanadham Oct. 1979 17 p refs Revised Submitted for publication
(INPE-1604-RPE/084-Rev) Avail: NTIS HC A02/MF A01

Mean monthly and annual values of total precipitable water are compared with mean monthly and annual values of surface dewpoint for each 5 deg latitude belt from equator to 85 deg S. The degree of relationship is good. However, the correlation coefficients are lower for latitudes 00 deg - 20 deg S than for latitudes 25 deg - 85 deg S. The computed regression equations give excellent estimates of precipitable water from surface dew-point for middle and higher latitudes in cooler seasons. Zonally averaged values of the moisture profile power index lambda for the Southern Hemisphere are presented. This power index is highly variable (-9.26(- or +) 4.57) even for mean monthly moisture profiles. The results obtained are useful for the zonally averaged climatic models. M.M.M.

N80-18634# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STABILITY PROPERTIES OF MEDIUM-SCALE DISTURBANCES IN A BALANCE MODEL

V. Brahmananda Rao and Nelson J. Ferreira Oct. 1979 32 p refs Revised Submitted for publication
(INPR-1591-RPE/078-Rev) Avail: NTIS HC A03/MF A01

Stability properties of medium scale disturbances, their structure and energetics are studied using a two layer balance model. Under normal static stability two modes of unstable disturbances are generated: conventional baroclinic wave and a medium scale disturbance. The vertical structure of the latter mode shows that it is shallow agreeing with the observations of Nitta and Yamamoto (1974). When the static stability is low, a deep medium scale disturbance is generated. This agrees with the observations of Reed (1979). Thus the shallow or deep nature of medium scale disturbance depends on the stability of the atmosphere. Author

N80-18635# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

INFRARED IMAGE ENHANCEMENT OBTAINED FROM METEOROLOGICAL SATELLITES [REALCE DE DADOS INFRAVERMELHO TRANSMITIDOS POR SATELITES METEOROLOGICOS]

Nelson Jesus Ferreira and Vernon Edgar Kousky Oct. 1979 29 p refs In PORTUGUESE
(INPE-1596-RPE/081) Avail: NTIS HC A03/MF A01

A series of curves utilized to enhance the infrared data obtained from meteorological satellites is shown. The high resolution of the images depicted the thermal characteristics of the continental surface as well as those of the ocean surface. It was noted that the areas showing greater convective activity and a probability of precipitation are easily identified. Transl. by M.M.M.

N80-18636*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A PRELIMINARY LOOK AT AVE-SESAME 1 CONDUCTED ON 10-11 APRIL 1979

Steven F. Williams (Texas A and M Univ., College Station), James R. Scoggins (Texas A and M Univ., College Station), Nicholas Horvath (Texas A and M Univ., College Station), and Kelly Hill Feb. 1980 62 p refs
(NASA-TM-78262) Avail: NTIS HC A04/MF A01 CSCL 04B

Preliminary information on the general weather conditions during the AVE-SESAME 1 period is presented together with a summary of severe weather reports. K.L.

N80-18637# Air Weather Service, Scott AFB, Ill.

ELECTRO-OPTICAL HANDBOOK. VOLUME 1: WEATHER SUPPORT FOR PRECISION GUIDED MUNITIONS

Kit G. Cottrell, Paul D. Try, Donald B. Hodges, and Ronald F. Wachtmann May 1979 107 p refs
(AD-A075168; AWS-TR-79-002) Avail: NTIS HC A06/MF A01 CSCL 04/1

A foundation for weather support to Precision Guided Munitions operating at visual through microwave wavelengths is established for use by Air Weather Service base weather station forecasters and staff weather officers. Chapter 1 describes the effects of the atmosphere and the Earth's surface on electromagnetic energy. Precision Guided Munitions (PGMs) and their sensitivities to the environment are discussed in Chapter 2. The next two chapters discuss weather support concepts and techniques to support PGMs. A glossary of terms, supplemental radiative transfer theory, and example worksheets illustrating support techniques to TV, infrared, and laser designator systems are included in the appendixes. GRA

N80-18638# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.

PERFORMANCE EVALUATION OF THE OPTICAL CROSSWIND PROFILER

Ruben Rodriguez and William J. Vechione Aug. 1979 82 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A075145; ERADCOM/ASL-TR-0038) Avail: NTIS HC A05/MF A01 CSCL 04/2

Field measurements of integrated path crosswinds were made at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period of 31 January to 8 March 1978. The measurements were made with the Optical Crosswind Profiler (OCP), a bistatic system that measures crosswinds at six locations along its path by detecting and analyzing the movement of atmospheric scintillations. This report describes the performance evaluation test, test support equipment, and data collection methodology. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. This report presents X-Y scatter plots, derived weighting functions, and wind measurement comparison plots. Results of this test showed that the alignment procedure is lengthy and tedious. Furthermore, simultaneous alignment of the six OCP sensors is very difficult to attain. However, once a sensor is aligned at 500 m, wind velocity values measured with it fall within 8 percent of the values obtained from the calibrated anemometer array. Operation at 2000 m is not reliable due to difficulties in obtaining and retaining alignment. GRA

N80-18639# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
PRECIPITATION ESTIMATION USING SATELLITE DATA
Bruce T. Miers Sep. 1979 44 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A075978; ERADCOM/ASL-TR-0039) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report attempts to show that, by fitting particular nonlinear auto-covariance and cross-covariance functions to space-time covariance values calculated from satellite data, convective complex characteristics such as size, ellipticity, motion, growth, and decay of a storm can be determined. These modeled features then can be related to convective storm characteristics found by Scofield and Oliver. In turn, these characteristics are related to actual rainfall amounts. The results of this study are a first step in removing the subjectivity from current rainfall estimation techniques. Results from the 20 May 1977 storm over Texas and Oklahoma are presented. GRA

N80-18640# Ballistic Research Labs., Aberdeen Proving Ground, Md.
METEOROLOGICAL MEASUREMENTS PROGRAM DURING UNIFIED NAVY FIELD TEST PROGRAM Final Report
John M. Evans, John W. Kinch, and John H. McNeilly Aug. 1979 852 p refs
(DA Proj. 1X2-63314-D-093)
(AD-A075459; AD-E430309; ARBRL-MR-02942) Avail: NTIS HC A99/MF A01 CSCL 04/2

The Ballistic Research Laboratory participated with the Unified Navy Field Test Program conducted at the TRW Capistrano Test Site near San Clemente, CA from the fall of 1976-May 1978. Part of the BRL's responsibility in this program was to provide the meteorological measurements and analysis. These measurements provided the data required to determine optimum high energy laser propagation windows, and to predict propagation results. Meteorological parameters included in these measurements are the horizontal wind velocity normal to the propagation path, barometric pressure, wind speed and direction at several fixed points, strength of atmospheric optical turbulence, net and total solar radiation, temperature, dew point, and relative humidity. This report describes the measurement and recording techniques of the meteorological parameters, and presents the data obtained. GRA

N80-18641# Naval Environmental Prediction Research Facility, Monterey, Calif.
SUMMARY OF AN EASTPAC REFRACTIVE STRUCTURE CLIMATOLOGY Final Report
Wayne Sweet Jul. 1979 33 p
(AD-A075456; NEPRF-TR-79-02) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report summarizes the most pertinent data and information contained in an earlier, in-depth refractive structure climatology, NEPRF TR 2-77 (MII), 'Development of a Synoptic Climatology of Tropospheric Refractive Conditions for the Eastern Pacific Ocean off the West Coast of the United States - Tasks One and Two.' Refractive structure data for five latitude zones of EASTPAC are given. Paragraph summaries discuss each of the selected statistics. GRA

N80-18642# Royal Netherlands Meteorological Inst., De Bilt.
WEATHER FORECASTING FOR THE CONSTRUCTION AND BUILDING INDUSTRY DURING THE WINTER 1976 - 1977 [RAPPORT BETREFFENDE DE WEERBERICHTGEVING VOOR DE BOUWNIJVERHEID IN DE WINTER 1976 - 1977]
J. J. Allan, A. P. A. Kleintjes, and D. M. vanderWoude 1977 25 p In DUTCH
(KNMI-V-296) Avail: NTIS HC A02/MF A01

The technical and organizational aspects of issuing forecasts for the construction industry are described, including the equipment required, forecast accuracy, and user acceptance. During the period under consideration, an average of 1900 telephone calls were received daily by the automatic answering service. Weather data for the period are presented. Author (ESA)

N80-18643# Royal Netherlands Meteorological Inst., De Bilt.
THE RELATION BETWEEN THE QUALITY OF THE WEEK LONG FORECAST AND THE QUALITY OF THE CURRENTLY USED GWL FORECAST [OVER HET VERBAND TUSSEN ENERZIJDS DE KWALITEIT VAN DE WEEKVERWACHTING EN ANDERZIJDS DE KWALITEIT VAN DE DAARBIJ GEBRUIKTE GWL-VOORSPELLING, ANOLOGIE EN 72-UUR PROG]
W. H. vandeGeer 1978 7 p In DUTCH
(KNMI-V-297) Avail: NTIS HC A02/MF A01

The production of one week weather forecasts using the long term analogous case method is presented. A computer program was used to compare cases from the previous month with those of the same month from a historical file dating from 1881. The most likely cases selected were used by experienced meteorologists to prepare the weekly forecast. Data elements considered include hours of sunshine, number of dry days, and maximum and minimum temperatures. Author (ESA)

N80-18644# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF FIGURE EXPECTATIONS [VERIFICATIE VAN CIJFERVERWACHTINGEN]
H. Daan 1978 25 p In DUTCH
(KNMI-V-298) Avail: NTIS HC A02/MF A01

A quantity, called the reference value, was defined and used as a tool to aid in weather forecasting. For nine weather elements, including maximum and minimum temperature, sunshine duration, and wind speed, a probability was expressed as this reference value. This number proved useful as a guide in weather discussions where meteorologists develop one day forecasts. Forecast verifications for the period 1971 to 1977 are presented. Author (ESA)

N80-18645# Royal Netherlands Meteorological Inst., De Bilt.
VERIFICATION OF OBJECTIVE FORECASTS BASED ON ANALOGIES [VERIFIKATIE VAN OBJECTIEVE OP ANALOGEN GEBASEERDE VERWACHTINGEN]
H. A. F. M. Otten 1978 18 p In DUTCH
(KNMI-V-300) Avail: NTIS HC A02/MF A01

A comparison between standard methods of making one and two day forecasts and an analogous case method are presented. Analogies for thirty past situations (the 500 mb level only) are examined. The weather which materialized at these situations being considered as a forecast is shown. Data are presented which indicate that the method can produce accurate forecasts. Author (ESA)

N80-18646# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS FROM ESTABLISHING SHORT TERM WEATHER FORECASTS BASED ON METHOD OF ANALOGIES [RESULTATEN VAN HET MAKEN VAN WEERSVERWACHTINGEN VOOR DE KORTE TERMIJN M.B.V. ANALOGENMETHODEN]
J. H. A. Bernard, E. Hoftstee, and J. Jerphanion 1978 14 p refs In DUTCH
(KNMI-V-301) Avail: NTIS HC A02/MF A01

Examples of an analogous case method which examine the stream patterns to produce forecasts are described. Results did not match the accuracy of the operational 24 hour forecasts. Author (ESA)

N80-18647# Royal Netherlands Meteorological Inst., De Bilt.
RESULTS FROM A STUDY OF WEEK LONG FORECASTS FOR 1975 - 1978 [RESULTATEN VAN ONDERZOEK AAN DE WEEKVERWACHTING OVER DE PERIODE 1975 - 1978]
J. Reiff and J. L. Nap 1978 9 p In DUTCH
(KNMI-V-302) Avail: NTIS HC A02/MF A01

Intercomparisons of several methods for producing one week weather forecasts are presented for 150 cases. Predictions are issued for maximum and minimum temperature, the number of dry days and circulation type (according to the GWL system).

The best analogous case method is compared with a presistency forecast starting with the forecast for day three. Author (ESA)

N80-18648# Royal Netherlands Meteorological Inst., De Bilt.
COMPUTER SYSTEM OPERATING MANUAL FOR THE METEOROLOGICAL MAST AT CABAUW [HANDLEIDING COMPUTERSYSTEEM MEETMAST CABAUW]
P. A. T. Nieuwendijk and J. C. vanVuure 1978 33 p In DUTCH
(KNMI-V-303) Avail: NTIS HC A03/MF A01

A minicomputer data gathering and reduction system was developed for a 200 m instruments meteorological tower. Data was taken with rapid response sensors for determination of energy balance and for turbulence measurements. The programs were written for a HP21MX in FORTRAN 4. The system permits data sampling as well as archiving on a disk drive. Author (ESA)

N80-18649# Royal Netherlands Meteorological Inst., De Bilt.
SOFTWARE PACKAGE DESCRIPTION FOR INSTRUMENT READINGS AT CABAUW [BESCHRIJVING VAN HET PROGRAMMAPAKKET T.B.V. DE ROUTINEREGISTRATIE TE CABAUW]
P. A. T. Nieuwendijk and J. G. vanderVliet 1978 43 p refs In DUTCH
(KNMI-V-306) Avail: NTIS HC A03/MF A01

A set of computer programs written in ALGOL was developed for processing and archiving meteorological data taken at the 213 m tower. The sample interval is 30 seconds. The program set permits the testing of raw data tapes, generation of temperature and wind profiles at half hour intervals, and the generation of permanent tape files. Instructions for the use of the system are presented. Author (ESA)

N80-18650# Royal Netherlands Meteorological Inst., De Bilt.
FREQUENCY DISTRIBUTIONS OF THE WIND VELOCITY AND THE WIND ENERGY OF THE LIGHTSHIPS TERSCHELLINGERBANK, TEXEL, GOEREE AND NOORDHINDER [FREKWENTIEVERDELINGEN VAN DE WINDSNELHEID EN DE WINDENERGIE VAN DE LICHTSCHEPEN TERSCHELLINGERBANK, TEXEL, GOEREE EN NOORDHINDER]
G. J. Yperlaan 1979 92 p ref In DUTCH
(KNMI-V-309) Avail: NTIS HC A05/MF A01

Tables of wind velocity and wind energy are presented, prepared from data taken at four coastal lightships off the coast of the Netherlands for use in studying the feasibility of wind power. Data was also taken at shore stations, but differences in collection methods make it difficult to compare the two data sets. Author (ESA)

N80-18651# Royal Netherlands Meteorological Inst., De Bilt.
THE INFLUENCE OF THE NUMBER OF PARTICIPANTS UPON THE WORKING MULTIDAY FORECASTS [DE INVLOED VAN HET AANTEL DEELNEMERS AAN HET OVERLAG BIJ DE OPSTELLING VAN MEERDAAGSE VERWACHTINGEN]
R. deBruijn 1979 13 p refs In DUTCH
(KNMI-V-310) Avail: NTIS HC A02/MF A01

The differences in quality of weather forecasts prepared by two person teams or three person teams were compared. In all cases, performance on Sundays was less adequate than on weekdays. The working of multi-day forecasts edited on Sundays by one or two meteorologists is less accurate than weekday forecasts edited by three meteorologists. The differences are not thought to be noticeable by the public. Author (ESA)

N80-18652# Royal Netherlands Meteorological Inst., De Bilt.
AN AUTOMATED SYSTEM FOR NUMERICAL FORECASTS OF TIDAL HEIGHTS, WIND-DRIVEN SEAS, FRONTAL WAVES AND SWELLS [EEN GEAUTOMATISEERD SYSTEEM VOOR NUMERIEKE VERWACHTINGEN VAN WATEROPZETTEN, ZEEGANG EN DEINING]
J. W. Sanders 1979 22 p refs In DUTCH
(KNMI-V-311) Avail: NTIS HC A02/MF A01

The operational program for producing short range forecasts of sea conditions in the shipping channel off the Netherlands is described. Because of the large draft of modern tankers, the water level and energy in the wave spectrum for periods longer than 10 sec must be known for the duration of the ships passage. A description of the numerical forecasting model which incorporates both meteorological and oceanographics parameters is presented. Author (ESA)

N80-18653# Royal Netherlands Meteorological Inst., De Bilt.
CORRECTIONS FOR FORWARDLY DISPERSED LIGHT WITH TRANSMISSOMETER (KNMI SHORT RANGE) [CORRECTIES VOOR VOORWAARTS VERSTROOID LICHT BIJ TRANSMISSOMETERS (KNMI KORTE BASIS)]
H. R. A. Wessels 1979 17 p refs In DUTCH
(KNMI-V-312) Avail: NTIS HC A02/MF A01

Measurements of the runway visual range (RVR) values taken with range transmissometers are compiled. It was found that the instruments contain a too large field of view, causing a 15 percent over evaluation of the RVR. Tables are presented for correcting the error bringing the remaining deviations to less than 6 percent. Author (ESA)

N80-18654# Royal Netherlands Meteorological Inst., De Bilt.
WIND MEASUREMENTS AT THE TV TOWER AT MARKELO [WINDMETING OP DE TV-TOREN TE MARKELO]
J. A. Mellink and C. A. Velds 1979 25 p refs In DUTCH
(KNMI-V-313) Avail: NTIS HC A02/MF A01

Wind speed and direction data taken for six weeks at a 170 m mast are compared with data from the 200 m instrumented tower at Cabuaw, as part of a feasibility study for a boundary layer meteorological network in the Netherlands utilizing television masts. Author (ESA)

N80-18655# Royal Netherlands Meteorological Inst., De Bilt.
ARE SEVERE WINTERS PRECEDED BY AN ABNORMAL CIRCULATION PATTERN IN THE FALL? [WORDEN STRENGE WINTERS VOORAFGEGAAN DOOR EEN ABNORMAL CIRKULATIEPATROON IN DE HERFST?]
J. vanRaalten 1979 8 p refs In DUTCH
(KNMI-V-315) Avail: NTIS HC A02/MF A01

Atmospheric circulation during the autumns preceding severe winters occurring between 1881-1975 was studied for evidence of abnormal circulation patterns. Data indicate that severe winters are preceded by an autumn in which northern circulation types are more frequent than usual. A forecasting rule is offered: that a necessary, but not sufficient condition for severe winters is that the preceding autumn is characterized by a sufficient number of northern circulation episodes. Author (ESA)

N80-18656# Royal Netherlands Meteorological Inst., De Bilt.
VARIATION OF METEOROLOGICAL PARAMETERS AT SELECTED SITES IN THE NETHERLANDS [VARIATIE NAAR TIJD EN PLAATS VAN EEN AANTAL WEERSELEMENTEN IN NEDERLAND]
J. M. Terpstra 1979 17 p refs In DUTCH
(KNMI-V-314) Avail: NTIS HC A02/MF A01

The hypothesis that the inclusion of place and time information in radio broadcast weather forecasts may diminish the utility of the forecast to the public was examined using actual data. For temperature, in 25 percent to 35 percent of the cases, the omission of place indication would have resulted in a less useful forecast because of large area variations. For wind velocity, 85 percent of the time, the difference between morning and noon wind is not more than one beaufort. In the cases where this difference exceeds one beaufort, indications of time and place may be important. Author (ESA)

N80-18657# Royal Netherlands Meteorological Inst., De Bilt.
ANALYSIS METHODS AND FRONT STRUCTURE [ANALYSEMETHODEN EN FRONTENSTRUCTUUR]
L. M. Hafkenscheid, J. H. A. Bernard, H. R. A. Wessels, J. Reiff, and M. J. M. Saraber 1979 59 p refs In DUTCH
Presented at Synoptisch Symp., De Bilt, Netherlands, 15-29 Nov. 1978
(KNMI-WR-79-2) Avail: NTIS HC A04/MF A01

New analytical methods and tools of interest to operational weather forecasters are presented, including the use of potential wet bulb temperature in frontal analysis and real time cross sections produced in the field. The distribution of precipitation is discussed in the context of warm and cold fronts. A recent trajectory model which uses windfield prognoses is described, which includes the vertical wind component. Author (ESA)

N80-18658# Royal Netherlands Meteorological Inst., De Bilt.
LONG RANGE WEATHER FORECASTING [MAAND- EN SEIZOENSVERWACHTINGEN. ACHTERGRONDEN VAN HET ONDERZOEK IN DE WG AC]
H. M. vandenDool, J. D. Opsteegh, J. Reiff, and J. Oerlemans 1979 11 p refs In DUTCH
(KNMI-V-317) Avail: NTIS HC A02/MF A01

Research in the Netherlands medium-to-long on range weather forecasting (one to four months) is discussed. Statistical dynamical models are thought to offer the best possibility for ever achieving workable forecasts. Author (ESA)

N80-18659# Royal Netherlands Meteorological Inst., De Bilt.
SYSTEMATIC WIND ERROR AND THE STANDARD PLUVIOMETRIC [EEN ONDERZOEK NAAR DE GROOTTE VAN DE SYSTEMATISCHE WINDFOUT VAN DE STANDAARD REGENMETER]
C. G. Dekker 1979 20 p refs In DUTCH
(KNMI-V-317) Avail: NTIS HC A02/MF A01

A comparison made between the reference ground pluviometer and the currently used national, pluviometer to determine the systematic error caused by wind effect is described. Comparison data taken at Eibergen, Noorosleen, Zandvoort, and DeBilt, Netherlands over a four year period are presented, showing the relationship between wind speed and systematic error by season. Author (ESA)

N80-18660# Royal Netherlands Meteorological Inst., De Bilt.
A QUASI-OBJECTIVE METHOD FOR PRECIPITATION PREDICTION [EEN KWASI-OBJEKTIEVE METHODE VOOR KWANTITATIEVE BENADERING VAN NEERSLAGHOEVEELHEDEN]
C. J. vanderGoot 1979 27 p refs In DUTCH
(KNMI-V-318) Avail: NTIS HC A03/MF A01

A computer model was developed for predicting quantitatively the amount of precipitation expected over a given area. The quantitative approximation was made quasi objectively using the flow at 500 Mb and the mean vertical speed, calculated twice daily. Results compare well with real data and the model may be applied as a first guess method in operational situations. Author (ESA)

N80-18661# Royal Netherlands Meteorological Inst., De Bilt.
A SUBJECTIVE WEATHER TYPOLOGY [NAAR EEN SUBJECTIEVE WEER-TYPOLOGIE]
H. Daan 1979 43 p refs In DUTCH
(KNMI-V-319) Avail: NTIS HC A03/MF A01

A classification scheme was developed in which synoptic weather data are analyzed graphically to produce a subjective description of weather by type. Temperature, precipitation, and sunshine data were input elements, but the classification was extended to include such special phenomena as thunderstorms, hail, snow, and fog as well as extreme conditions such as frost, very high or low temperature, and severe storms. The classification scheme encompasses 36 types of weather. Frequency of occurance and an evaluation of the system using real data are presented. Some data elements become irrelevant in defining extreme weather conditions. Author (ESA)

N80-18662# Royal Netherlands Meteorological Inst., De Bilt.
PRECIPITATION, OPEN WATER EVAPORATION AND POTENTIAL PRECIPITATION SURPLUS IN THE NETHERLANDS: FREQUENCY DISTRIBUTIONS IN THE GROWING SEASON , [NEERSLAG, OPENWATERVERDAMPING EN POTENTIEEL NEERSLAGOVERSCHOT IN NEDERLAND. FREQUENTI EVERDELINGEN IN HET GROEISEIZOEN]
H. A. R. deBruin 1979 99 p refs In DUTCH; ENGLISH summary
(KNMI-WR-79-4) Avail: NTIS HC A05/MF A01

An objective parameter for defining a wet or a dry growing season is defined as precipitation (RR), open water evaporation (EO) and the potential precipitation surplus (RR-Epot) where Epot is the potential evaporation. Frequency distributions for these quantities are given for April to October for selected stations. The theoretical background of the three quantities is discussed. Measurement techniques at the sites are presented with statistical analyses of the time series for the quantities. Author (ESA)

N80-18663# Stockholm Univ. (Sweden). Dept. of Meteorology.
NUMERICAL STUDY OF PARTICLE GROWTH AND WATER VAPOR CONCENTRATION IN NOCTILUCENT CLOUDS
Ingemar Kinnmark Jan. 1979 61 p refs Prepared jointly with Intern. Meteorol. Inst.
(AP-18) Avail: NTIS HC A04/MF A01

An existing model was adapted to yield the distribution function of noctilucent cloud particles according to radius and altitude and the various assumptions regarding the temperature profile, water vapor mixing ratio, turbulent diffusion, and updraft. The specific numerical procedure known as the method of characteristics was employed. The theoretical background of this technique and the preliminary results obtained for an atmosphere with no vertical wind are presented. It is established that under the peculiar physical conditions near the mesopause the particle distribution has a well-defined peak whose position varies with the assumed water concentration and that this maximum is followed by a very sharp cut-off towards larger radii. Assuming that turbulent transport is described by the classical eddy diffusion concept, only limited changes in the mixing-ratio profile are found. Author (ESA)

N80-18664# Royal Netherlands Meteorological Inst., De Bilt.
CORRELATIONS BETWEEN THE 500 mb CIRCULATION AND THE WEATHER IN THE NETHERLANDS [CORRELATIES TUSSEN DE 500 mbar-STROMING EN HET WEER IN NEDERLAND]
H. Daan 1979 15 p refs In DUTCH
(KNMI-V-321) Avail: NTIS HC A02/MF A01

A method of presenting numerical weather data for eastern visualization from the synoptic point of view were developed. Correlations between the height of the 500 mb surface and percentage of sunshine, maximum and minimum temperatures, and wind data were computed for the years 1949 to 1972 and are shown in charts. Methods for interpreting the charts are given. Author (ESA)

N80-18665# Royal Netherlands Meteorological Inst., De Bilt.
DESCRIPTION OF A GRADIENT VERIFICATION PROGRAM AND A COMPARISON BETWEEN OBJECTIVELY AND SUBJECTIVELY PERFORMED VERIFICATION OF THE PREDICTED CURRENTS FROM BK4 [BESCHRIJVING VAN EEN GRADIENT-VERIFICATIE VE MET DOOR METEOROLOGEN VERRICHTE SUBJECTIEVE VERIFICATIE VAN HET VOORSPELD STROMINGSPATROON VAN BK4]
L. C. Heijboer 1979 36 p refs In DUTCH
(KNMI-V-322) Avail: NTIS HC A03/MF A01

An intercomparison of forecasts of wind driven sea heights procured by several different computer models with subjective forecasts was performed. Judgements of the accuracy of forecasts produced by earlier versions of the models T3 and T4 were inconclusive, but forecasts from version T5 compared favorably with Bracknell version BK4 which is based upon the 500 mb and 1000 mb hemisphere analysis from Bracknell. Author (ESA)

N80-18666# Royal Netherlands Meteorological Inst., De Bilt.
FAST CONVERGENT ITERATION PROCEDURE FOR CALCULATING THE ISOBARIC WET BULB TEMPERATURE [SNEL CONVERGERENDE ITERATIEPROCEDURE VOOR HET BERSKENEN VAN DE (ISOBARISCHE) NATTEBOLTEMPERATUR]
L. M. Hafkenscheid 1979 7 p In DUTCH
(KNMI-V-327) Avail: NTIS HC A02/MF A01

The calculation of the wet bulb temperature with a given pressure, atmospheric pressure, and temperature with the psychrometer formula has been described. In linear approximation the equation is not solvable analytically. An approximation formula is used to produce a numerical solution, which is shown. Author (ESA)

N80-18463*# Observatoire de Meudon (France).
THE FORECASTING CENTER OF MEUDON, FRANCE
Paul Simon *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 1-11 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-18667* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OCEANIC WAVE MEASUREMENT SYSTEM Patent
John F. Holmes (Computer Sciences Corp., Falls Church, Va.) and Ronald T. Miles, inventors (to NASA) (Computer Sciences Corp., Falls Church, Va.) Issued 22 Jan. 1980 6 p Filed 16 Oct. 1978 Supersedes N79-10689 (17 - 01, p 0091) Sponsored by NASA
(NASA-Case-MFS-23862-1; US-Patent-4,184,368; US-Patent-Appl-SN-951423; US-Patent-Class-73-170A) Avail: US Patent and Trademark Office CSCL 08C

An oceanic wave measured system is disclosed wherein wave height is sensed by a barometer mounted on a buoy. The distance between the trough and crest of a wave is monitored by sequentially detecting positive and negative peaks of the output of the barometer and by combining (adding) each set of two successive half cycle peaks. The timing of this measurement is achieved by detecting the period of a half cycle of wave motion. Official Gazette of the U.S. Patent and Trademark Office

N80-18668 California Univ., San Diego.
MICROSCALE MEASUREMENTS OF TEMPERATURE IN THE UPPER OCEAN FROM A TOWED BODY Ph.D. Thesis
John Carl Schedvin 1979 459 p
Avail: Univ. Microfilms Order No. 8002945

Measurements of small scale fluctuations of temperature in the upper ocean were obtained using a towed instrumentation system. Vertical profiling of the tow body, due to ship motion, showed a complex structure of pancake shaped regions. The mean vertical temperature gradient and microstructure spectral properties were homogeneous within each region, implying a common hydrodynamic origin. Towed body motions and vibrations were measured, and their effects on the temperature signals were examined. Vibrational contamination was significant, and is identified as coming from variations in the resistance of a connector in series with the low impedance, platinum film temperature sensor. It was found that comparison of the effective rate of strain to the Brunt-Vaisala frequency is a criterion for discrimination between active and fossil turbulence. Fossil turbulence regions were observed at most depths, but because the active turbulence required to produce them was not observed, it was concluded that the mixing and diffusive processes at these depths were undersampled. Dissert. Abstr.

N80-18669 Connecticut Univ., Storrs.
WAVELIKE BAROCLINIC DISTURBANCES ON SHALLOW UPPER OCEAN DENSITY FRONTS Ph.D. Thesis
Richard Anthony Formato 1979 224 p
Avail: Univ. Microfilms Order No. 8003745

A theoretical development of small amplitude wave disturbances on oceanic fronts is presented. The prototype front is the inshore boundary of the Gulf Stream. A two layer model is considered in which the lower layer is much deeper than the upper, lighter layer. The frontal zone that forms the horizontal boundary of the upper layer is divided into two regions, a smaller, inner region in which the flow is dissipative and depends upon interfacial mass entrainment and turbulent friction, and a larger, outer region in which the motion is inviscid. The boundary between these two regions is placed where the internal Froude number is of order one. Both geostrophic and ageostrophic basic state (nontime varying) flows are considered under the f plane approximation. Dissert. Abstr.

N80-18670 Connecticut Univ., Storrs.
EARLY DIAGENESIS OF TRACE METALS IN NEARSHORE LONG ISLAND SOUND SEDIMENTS Ph.D. Thesis
William Berry Lyons 1979 274 p
Avail: Univ. Microfilms Order No. 8003752

Sedimentary pore waters were obtained seasonally from two nearshore areas in Long Island Sound, Branford Harbor, Ct. and Mystic River Estuary, Ct. The pore waters were collected, separated from the sediments and analyzed utilizing inert atmospheric and ultraclean laboratory techniques in order to minimize any artificats due to improper sampling and contamination. The pore fluids and the sediments were analyzed for a variety of major and minor components as well as the trace metals, Fe, Mn, Zn, Cu, Pb, Cd and Ag. Sediments from these two areas were anoxic and bacterially mediated sulfate reduction was the major biogeochemical process taking place. As this process proceeded, SO4(2-) was consumed, sedimentary organic matter was oxidized and HS(-), PO4(3-), NH4(+), titration alkalinity and dissolved organic carbon was produced. Other significant observations as well as the results are reported. Dissert. Abstr.

N80-18671# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COASTAL WATER TEMPERATURES IN THE SOUTHEASTERN PORTION OF BRAZIL FROM OCEANOGRAPHIC DATA AND NOAA SATELLITE OBSERVATIONS, VOLUME 1 [TEMPERATURAS DAS AGUAS DA COSTA SUDESTE DO BRASIL, OBTIDAS ATRAVES DE DADOS OCEANOGRAFICOS E DE DADOS DE SATELITES DA SERIE NOAA, VOLUME 1]
Hector Manuel Inostroza Villagra and Jose Luiz Stech Sep. 1979 101 p refs In PORTUGUESE; ENGLISH abstract
(INPE-1569-RPE/070) Avail: NTIS HC A06/MF A01

Sub surfzce temperature charts in the southeastern coest of Brazil, utilizing oceanographic data and thermal sensor data of NOAA's satellites are presented. A detailed analysis of 350 oceanographic stations resulted in the finding of a marked seasonal tendency in the vertical temperature structure of the waters. A correlation was established between the surface and vertical thermal structure. The analysis was done on a weekly time basis with the year 1970 as the reference year. Temperature charts at the depth of 50 m were done for the four seasons of the year, as an example of the applicability of the model, with results considered as satisfactory in a first approach. M.M.M.

N80-18672*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MISSION AND SENSOR CONCEPTS FOR COASTAL AND OCEAN MONITORING USING SPACECRAFT AND AIRCRAFT
W. L. Darnell Jan. 1980 48 p refs
(NASA-TM-80103) Avail: NTIS HC A03/MF A01 CSCL 08C

A concept developed for a 1990 oceanic mission which places strong emphasis on coastal monitoring needs is described and analysed. The concept assumes that use of one active spacecraft in orbit and one on standby plus airplanes and data collection platforms which provide continuing complementary coverage and surface truth. The coastal measurement requirements and goals, the prospective oceanic and coastal sensors, the spacecraft and aircraft data platforms, and the prospective orbit designs are discussed. A.W.H.

N80-18673# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF OCEANIC LITHOSPHERE USING GEOS-3 RADAR ALTIMETER DATA Final Report, 1 Oct. 1977 - 30 Sep. 1979
M. C. Roufosse Jul. 1979 29 p refs
(Contract F19628-78-C-0003; AF Proj. 2309)
(AD-A077344; AFGL-TR-79-0181) Avail: NTIS HC A03/MF A01 CSCL 08/7

The aim of this work is to study the mechanical properties and time evolution of the lithosphere. For that purpose, geoid heights derived from the Geos 3 radar altimeter were used. The study of the correlation existing between bathymetry and free-air anomalies or geoid heights gives information on the mechanical properties of the lithosphere and its thickness. The lithospheric thickness is related to the age of the lithospheric plate, and by probing several locations spanning varied temporal situations, one is able to retrace the time evolution of the lithospheric plates. Toward that aim, several seamount chains, islands, and ridges have been investigated in the Pacific, Atlantic, and Indian Oceans. In the regions studied so far, the age of the lithosphere at the time of loading is the primary parameter. In this work, the author attempts a systematic study of all the parameters influencing the observed mechanical properties of the lithosphere. GRA

N80-18674# National Academy of Sciences - National Research Council, Washington, D. C. Ship Research Committee.
A SUMMARY OF WAVE DATA NEEDS AND AVAILABILITY Final Report
M. D. Burkhart, E. S. Dillon, and O. H. Oakley Aug. 1979 30 p
(Contract DOT-CG-80356-A)
(AD-A076067) Avail: NTIS HC A03/MF A01 CSCL 08/3

The paper consists of three parts. First is a summary of the wave data needs of three classes of maritime interests: (a) designers of ships and floating and fixed offshore platforms, (b) regulatory bodies and classification societies primarily interested in safety and environmental protection, and (c) operators concerned with ship routing and offshore activities such as oil and mineral recovery and energy production. The second part is a summary of the status of wave data, and the third part is a set of conclusions. The present wave data base to meet the developing needs of designers of ship and offshore structures, regulatory bodies, and operators is incomplete. To complete it using only in situ measurement methods such as buoys appears impractical. However, these do have important use in the collection of data for special areas of interest, particularly where severe seas are known to occur, and for verification and calibration of hindcast and satellite measurement techniques. The two most promising means of developing the required wave climatology appear to be: (a) by hindcasting techniques and (b) by satellite observations. Hindcasting techniques, which can produce broadband directional spectra, are well advanced but require additional verification. Satellite techniques and hardware will not be available for some years. Visual observations by mariners continue; although these observations cannot provide quantitative (spectral) data, they are valuable for estimating long-term wave-height distribution. GRA

N80-18675# Bertram Associates, Merrimack, N.H.
REMOTE IDENTIFICATION OF A SALT WATER WEDGE THROUGH DISSIPATIVE MEDIA WITH A MONOCYCLE RADAR
C. L. Bertram and R. A. Shore Oct. 1979 125 p refs
(Contract N00014-79-C-0160)
(AD-A076621) Avail: NTIS HC A06/MF A01 CSCL 08/3

One purpose of this study is to show theoretically the potential of a monocycle technique to detect and identify salt water wedges under dissipative fresh water. Also, the potential use for bathymetry is discussed, in particular for bodies of water of extremely low salinities as may be expected in some parts of the Baltic Sea, in Fjords and in large estuaries. The importance of bathymetry for military operations in shallow water is well known. It happens to be that some bodies of water with very low salinity are in areas of particular military sensitivity. Salt water wedges are of military importance for small submarines, swimmers and swimmer delivery vehicles and mine and counter mine warfare. GRA

N80-18676# American Inst. of Biological Sciences, Arlington, Va.
SYMPOSIUM ON DISSERTATIONS ON CHEMICAL OCEANOGRAPHY
1979 77 p refs Symp. held at Arlington, Va., 8-12 Oct. 1979
(Contract N00014-78-C-0140)
(AD-A078526) Avail: NTIS HC A05/MF A01 CSCL 08/10

Contents: Ion Association and Activity Coefficients in Electrolyte Solutions; Activity Effects in Seawater and Other Saline Mixtures; Volatile Organic Compounds in Seawater; The Interactions between Copper and Organic Matter in Coastal Seawater; Vertical Transportation of Organic Materials in Oceanic Environments; An Investigation of Vertical Mixing Rates in Fjords Using Naturally Occurring Radon-222 and Salinity as Tracers; The Geochemistry of Radium-226 and Radium-228 in Marine Deposits; The Dissolution Kinetics of Biogenic Calcium Carbonate; Sedimentary Geochemistry of Hydrocarbons from Narragansett Bay, Rhode Island; Early Diagenesis of Trace Metals in Nearshore Long Island Sound Sediments; Rates of Sediment Accumulation and Their Bearing on Metallogenesis on the Nazca Plate, Southeast Pacific; Discrete Suspended Particles of Barite and the Barium Cycle in the Open Ocean; Trace Metal-Organic Matter Interactions in Anoxic Marine Sediments during Early Diagenesis; Factors Influencing the Phase Partitioning of Iron and Associated Elements during Early Diagenesis in Shallow Marine Sediments; The Chemistry of Salt Marsh Sediments; Benthic Nutrient Regeneration and Sediment-Water Exchange in an Organic-Rich Coastal Sediment Cape Lookout Bight, North Carolina; The Role of Zooplankton Fecal Material in the Cycling and Deposition of Particulate Matter in an Estuarine and Deep-Oceanic Region of the North Eastern Pacific Ocean. GRA

N80-18677# Naval Research Lab., Washington, D. C. Applied Ocean Acoustics Branch.
SOME BASIC ASPECTS OF OCEANIC INTERNAL WAVES AND THE SOUND-SPEED FLUCTUATIONS THEY GENERATE Interim Report
David R. Palmer (Univ. of Miami, Fla.) 26 Oct. 1979 16 p refs
(ZF52552003)
(AD-A077537; AD-E000337; NRL-MR-4098) Avail: NTIS HC A02/MF A01 CSCL 20/1

This report is a selective summary of some recent work concerned with mathematically characterizing those fluctuations in the speed of sound which are the result of oceanic internal waves. GRA

N80-18678# Research Inst. of National Defence, Stockholm (Sweden).
TESTS OF LASER INDUCED FLUORESCENCE FROM ALGAE AT SEA [LASERINDUCERAD FLUORESCENS FRAAN ALGER. RESULTAT FRAAN ETT BAATBURET FAELTFOERSOEK]
Brit Hartmann, Ove Steinvall, and Anders Widen Jul. 1979 52 p refs In SWEDISH
(FOA-C-30171-E1) Avail: NTIS HC A04/MF A01

Fluorescence from algae illuminated by a boat mounted laser was measured to see if the technique is feasible for airborne ocean surveillance of algae concentrations and oil or chemical spills. Good agreement was found between the laser data and manually gathered data, but uncertainty about chlorophyll concentrations requires that the airborne system be complemented with a ground truth calculation method in some parts of the area surveyed. Author (ESA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-18679*# California Univ., Berkeley. Environmental Physiology Lab.
METHODOLOGY FOR ESTIMATION OF TOTAL BODY COMPOSITION IN LABORATORY MAMMALS
Nello Pace, Donald F. Rahlmann, and Arthur H. Smith 14 Dec. 1979 44 p refs
(Grant NsG-7336)
(NASA-CR-162806; EPL-79-1) Avail: NTIS HC A03/MF A01 CSCL 06C

A standardized dissection and chemical analysis procedure was developed for individual animals of several species in the size range mouse to monkey (15 g to 15 kg). The standardized procedure permits rigorous comparisons to be made both interspecifically and intraspecifically of organ weights and gross chemical composition in mammalian species series, and was applied successfully to laboratory mice, hamsters, rats, guinea pigs, and rabbits, as well as to macaque monkeys. The procedure is described in detail. R.E.S.

N80-18680*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE CARBON ISOTOPE BIOGEOCHEMISTRY OF THE INDIVIDUAL HYDROCARBONS IN BAT GUANO AND THE ECOLOGY OF INSECTIVOROUS BATS IN THE REGION OF CARLSBAD, NEW MEXICO
David J. DesMarais, J. M. Mitchell (Indiana Univ., Bloomington), W. G. Meinschein (Indiana Univ., Bloomington), and J. M. Hayes

Feb. 1980 46 p refs
(NASA-TM-81164; A-8056) Avail: NTIS HC A03/MF A01
CSCL 06C

The structures and C-13 contents of individual alkanes extracted from bat guano found in the Carlsbad region of New Mexico can be related to both the photosynthetic pathways of the local plants and the feeding habits of the insects that support the bats. Carbon isotopic analyses of the 62 most important plant species in the Pecos River Valley, the most significant feeding area for the Carlsbad bats, reveal the presence of 29 species with C3 photosynthesis and 33 species, mostly grasses, with C4 photosynthesis. Although the abundances of nonagricultural C3 and C4 plants are similar, alfalfa and cotton, both C3 plants, constitute over 95 per cent of the crop biomass. The molecular composition of the bat guano hydrocarbons is fully consistent with an insect origin. Two isotopically distinct groups of insect branched alkanes were discerned. These two groups of alkanes derived from two chemotaxonomically distinct populations of insects possessing distinctly different feeding habits. It is likely that one population grazes predominantly on crops whereas the other population prefers native vegetation. This and other isotopic evidence supports the notion that crop pests constitute a major percentage of the bats' diet. Author

N80-18681*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF THE ENZYMATIC INHIBITOR OF KUNITZ ON THE GASTRIC LESIONS FROM RESERPINE, FROM PHENYLBUTAZONE, FROM PYLORIC LIGATION AND BY RESTRAINT IN THE RAT

F. Guerrin, A. Demaille, P. Merveille, and C. Bel Feb. 1980 9 p refs Transl. into ENGLISH from Comp. Rend. Soc. Biol. (Paris), v. 159, no. 5, 1965 p 1172-1174 In ENGLISH and FRENCH Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76027) Avail: NTIS HC A02/MF A01 CSCL 06C

The protective effects of certain polypeptides on gastric ulcerations caused from reserpine and phenylbutazone in the rats were studied. It was found that the Kunitz enzymatic inhibitor exerts a protective action in regard to gastric lesions. However, the inhibitor did not change the development of Shay ulcers and stress ulcers from restraint. R.E.S.

N80-18682*# National Aeronautics and Space Administration, Washington, D. C.

MULTIPURPOSE ROTATING MACHINE FOR IMMOBILIZATION AND CONDUCTING STUDIES ON SMALL LABORATORY ANIMALS

N. F. Kornelishin 9 Feb. 1980 7 p refs Transl. into ENGLISH from Patol. Fiziol. Eksp. Ter. (USSR), no. 5, Sep. - Oct. 1979, p 80-82 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76049) Avail: NTIS HC A02/MF A01 CSCL 14B

A new device assisting the researcher in conducting laboratory experiments on small animals is described. Its advantages over extant machines are discussed. R.E.S.

N80-18683*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF RESTRICTED MOTION IN HIGH TEMPERATURE ON ENZYMATIC ACTIVITY OF THE PANCREAS

A. Abdusattarov and G. I. Smirnova Feb. 1980 6 p refs Transl. into ENGLISH from Uzbeksk. Biol. Zh. (USSR), no. 1, 1979 p 35-37 Transl. by Sci. Transl. Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76063) Avail: NTIS HC A02/MF A01 CSCL 06C

Effects of 30 day hypodynamia coupled with high temperature (35-36 C) on enzymatic activity of the pancreas of male adult rats were studied. The test animals were divided into four groups. Group one served as controls (freedom of movement and a temperature of 25-26 C, considered optimal). The remaining animals were divided into three additional groups: Group two freedom of movement but high temperature (35-36 C); group three hypodynamia but an optimal temperature; group four hypodynamia and 35-36 C. Considerable change in the enzymatic activity in the pancreas of the four groups is observed in three experimental groups (two, three, and four) as compared to the control (group one). The results indicate that adaption of the organism to the thermal factor and restricted movement is accompanied by a change in the enzymatic spectrum of the pancreas. With the combined effect of these two stresses under conditions of the adaption of the organism especially sharp shifts occur in the enzymatic activity. R.E.S.

N80-18684*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF CONSECUTIVE COOLING AND IMMOBILIZATION ON CATECHOLAMINE METABOLISM IN RAT TISSUES

E. Sh. Matlina, S. M. Waysman, I. G. Zaydner, B. M. Kogan, and L. V. Nozdracheva Nov. 1979 19 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 60, no. 4, Apr. 1974 p 540-547 Trans. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75962) Avail: NTIS HC A02/MF A01 CSCL 06C

The combined effect of two stressor stimuli--cooling and immobilization--acting successively on the sympathetic-adrenaline system was studied experimentally in rats that were cooled for 8 hours at 7 C on the first day and immobilized for 6 hours on the next day. The biochemical and histochemical methods used and the experimental technique involved are described in detail. The following conclusions were formulated: (1) the successive action of cooling and immobilization results in a stronger decrease in the adrenaline and noradrenaline content in the adrenal gland than that which could be due to a simple summation of the cooling and immobilization effects; (2) successive cooling and immobilization are followed by activation of catecholamine synthesis in the adrenal gland; and (3) 1-DOPA administration (45 mg/kg 3 times in 2 days) intraabdominally activated catecholamine synthesis in the adrenal glands in both the control and test animals. R.E.S.

N80-18685*# National Aeronautics and Space Administration, Washington, D. C.

THE EFFECTS OF ADRENALECTOMY AND CORTICSTEROID INJECTION ON THE FIBRINOLYTIC ACTIVITY OF COMPLEX HEPARIN COMPOUNDS IN THE BLOOD DURING IMMOBILIZATION

B. A. Kudryashov, E. G. Lomovskaya, F. B. Shapiro, and L. Ya. Lyapina Feb. 1980 11 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (USSR), v. 59, no. 7, 1973 p 1108-1113 Original language document announced as A75-31019 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Moscow State Univ., USSR
(Contract NASw-3199)
(NASA-TM-75985) Avail: NTIS HC A02/MF A01 CSCL 06C

Total non-enzymatic fibrinolytic activity in the blood of rats increased three times in response to stress caused by 30 minute immobilization, and the activity of epinephrine-heparin complex increased nine times. In adrenalectomized animals, which showed a weak response to the same stress, intraperitoneal injection of hydrocortisone 30 minutes prior to immobilization normalized the response. Obtained results indicate that adrenalectomy leads to sharp reduction of heparin complexing with thromogenic proteins and epinephrine, while substitution therapy with hydrocortisone restores anticoagulation system function. Author

N80-18686*# National Aeronautics and Space Administration, Washington, D. C.

INFLUENCE OF AMBIENT TEMPERATURES ON THE PRODUCTION OF RESTRAINT ULCERS IN THE RAT

L. Buchel and D. Gallaire Feb. 1980 7 p refs Transl. into ENGLISH from Soc. Biol. C. R. Seances, (France), v. 160, no. 10, 1966 p 1817-1820 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76028) Avail: NTIS HC A02/MF A01 CSCL 06C

A study of the influence of ambient temperature on the production of restraint ulcers in the rat is described. It concludes that the production of restrain ulcers, is favored by the reduction of the environmental temperature, whether the rat has been subjected to a fast or not. R.E.S.

N80-18687*# National Aeronautics and Space Administration, Washington, D. C.
FEATURES OF CHOLINERGIC CARDIA REGULATION UNDER CONDITIONS OF HYPOKINESIA
Ye. A. Markova, Yu. I. Bondarenko, V. A. Bolyarskaya, V. V. Fayfura, A. P. Rosolovskiy, and L. N. Babinskaya Feb. 1980 10 p refs Transl. into ENGLISH from Patologhk. Fiziol. Eksp. Terapiya (USSR), no. 3, 1979 p 13-16 Transl. by Kanner (Leo) Associates Redwood City, Calif.
(Contract NASw-3198)
(NASA-TM-76044) Avail: NTIS HC A02/MF A01 CSCL 06C

The features of cholinergic processes in the heart on the 4th, 8th, 16th and 30th days of hypokinesia were studied in experiments on 382 albino rats. It was shown that hypokinesia is attended by increased acetylcholine content in the atria, reduced choline acetyltransferase activity in the atria and ventricles and by increased activity of acetylcholinesterase in the ventricles and of pseudocholinesterase in both parts of the heart. The sensitivity of the heart to exogenic acetylcholine and to stimulation of the vagus nerve increases. Author

N80-18688*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECTS OF STIMULATION OF THE ANTERIOR CINGULATE GYRUS IN CATS WITH FREEDOM OF MOVEMENT
G. Dapres, J. Cadilhac, and P. Passouant Feb. 1980 8 p refs Transl. into ENGLISH from Compt. Rend. Soc. Fr. Gynecol. (France), v. 161, no. 3, 1967 p 657-660 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76055) Avail: NTIS HC A02/MF A01 CSCL 06C

Stimuli of varying strength, frequency and duration were applied to the anterior cingulate gyrus in unanesthetized cats with freedom of movement. The motor, vegetative and electrical effects of these stimuli, although inconstant, lead to a consideration of the role of this structure in the extrapyramidal control of motricity. Author

N80-18689*# National Aeronautics and Space Administration, Washington, D. C.
TOPOCHEMICAL DIFFERENCES IN THE AMOUNT OF RNA IN THE MOTONEURONS OF THE SPINAL CHORD IN HYPOXIA AND HYPOKINESIA
V. A. Brumberg, O. G. Gazenko, N. N. Demin, V. B. Malkin, and L. Z. Pevzner Feb. 1980 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), vol. 205, no. 6, 1972 p 1490-1493 Original language document was announced as A73-12558 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75994) Avail: NTIS HC A02/MF A01 CSCL 06C

Reactions to hypoxia and hypoknesia were compared by measuring charges in the amount of ribonucleic acid (RNA) in the cytoplasm of neurons of the intumescentia cervicalis and lumbalis. Animals were subjected to hypoxia, hypokinesia and both combined and a control group to neither. A total of two groups of motoneurons were compared, one innervating the respiratory musculature, the other the musculature of the lower extremities, so that hypoxic hypoxia would probably affect the first group primarily and hypokinesia the second. Results indicate that neither affect the amount of RNA in the neurons of the first group but a significant increase is noted in neurons of the second group. Other significant results are reported. R.C.T.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-18690* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRA-OCULAR PRESSURE NORMALIZATION TECHNIQUE AND EQUIPMENT Patent
William J. McGannon, inventor (to NASA) Issued 22 Jan. 1980 5 p Filed 31 Aug. 1977 Supersedes N77-30727 (15 - 21, p 2839)
(NASA-Case-LEW-12723-1; US-Patent-4,184,491;
US-Patent-Appl-SN-829317; US-Patent-Class-128-276;
US-Patent-Class-128-760) Avail: US Patent and Trademark Office CSCL 06B

A method and apparatus for safely reducing abnormally high intraocular pressure in an eye during a predetermined time interval is presented. This allows maintenance of normal intraocular pressure during glaucoma surgery. According to the invention, a pressure regulator of the spring biased diaphragm type is provided with additional bias by a column of liquid. The height of the column of liquid is selected such that the pressure at a hypodermic needle connected to the output of the pressure regulator is equal to the measured pressure of the eye. The hypodermic needle can then be safely inserted into the anterior chamber of the eye. Liquid is then bled out of the column to reduce the bias on the diaphragm of the pressure regulator and, consequently, the output pressure of the regulator. This lowering pressure of the regulator also occurs in the eye by means of a small second bleed path provided between the pressure regulator and the hypodermic needle. Alternately, a second hypodermic needle may be inserted into the eye to provide a controlled leak off path for excessive pressure and clouded fluid from the anterior chamber.
Official Gazette of the U.S. Patent and Trademark Office

N80-18691* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INDUCTION POWERED BIOLOGICAL RADIOSONDE Patent
Thomas B. Fryer, inventor (to NASA) Issued 5 Feb. 1980 12 p Filed 12 May 1977 Supersedes N77-23743 (16 - 14, p 1894)
(NASA-Case-ARC-11120-1; US-Patent-4,186,749;
US-Patent-Appl-SN-796256; US-Patent-Class-128-748;
US-Patent-Class-128-903; US-Patent-Class-73-724) Avail: US Patent and Trademark Office CSCL 06B

An induction powered implanted monitor for epidurally measuring intracranial pressure and telemetering the pressure information to a remote readout is disclosed. The monitor utilizes an inductance-capacitance (L-C) oscillator in which the C comprises a variable capacitance transducer, one electrode of which is a small stiff pressure responsive diaphragm. The oscillator is isolated from a transmitting tank circuit by a buffer circuit and all electric components in the implanted unit except an input and an output coil are shielded by a metal housing.
Official Gazette of the U.S. Patent and Trademark Office

N80-18692 Kent State Univ., Ohio.
THE EFFECTS OF SPECTRAL DENSITY AND STIMULUS INTENSITY ON THE ELICITATION OF THE ACOUSTIC REFLEX Ph.D. Thesis
Colleen Ann Mcaleer 1979 159 p
Avail: Univ. Microfilms Order No. 8003475

The acoustic reflex (AR) responses of normal hearing and hearing-impaired subjects elicited by moderate and high tensity stimuli when the stimulus energy was contained within an AR critical band were compared. The effects of minimum and maximum spectral density of the elicitation and growth of the AR were also investigated. The results show that ARTs were higher in dB sound pressure level for all four stimulus conditions for the hearing-impared than for the normal hearing subjects. Additionally, stimulus spectral density within a critical band had a differential effect on the elicitation of the AR for normal hearing and hearing-impaired subjects. The differences between the AR responses of normal hearing and hearing-impaired subjects could be attributed to the anatomical and physiological changes that accompany a noise-induced hearing loss. Dissert. Abstr.

N80-18693 Florida Univ., Gainesville.
FATIGUE IN SKELETAL MUSCLE Ph.D. Thesis
Brian Robert Macintosh 1979 118 p
Avail: Univ. Microfilms Order No. 8002876

Skeletal muscle fatigue is examined utilizing an in situ dog gastrocnemius-plantaris muscle preparation. Skeletal muscle fatigue (reduced force output for a given stimulus) results from a thirty minute period of isometric contractions at 2.5 to 20/sec. This fatigue is not a result of failure of motor nerve propagation or transmitter release. The ratio of oxygen uptake to developed tension is unaltered during or following fatiguing contractions. Energy sources are available and with maximal activation the contractile mechanism is capable of the same force output it had before the fatiguing contractions. Further, there is no reduction in twitch developed tension associated with intracellular acidosis. It appears that twitch fatigue results from a reduced activation of the myofilaments during a twitch contraction. This may be due to either a reduced sarcoplasmic Ca2(+) concentration during contraction or a reduced response of the myofilaments at a given CA2(+) concentration. Dissert. Abstr.

N80-18694 Virginia Univ., Charlottesville.
MICROVASCULAR DETERMINANTS OF OXYGEN SUPPLY IN RESTING AND CONTRACTING STRIATED MUSCLE Ph.D. Thesis
Bruce Maurice Klitzman 1979 138 p
Avail: Univ. Microfilms Order No. 8002544

The alteration of striated muscle oxygen supply in response to increases in oxygen demand induced by twitch contraction was examined. The approach taken was to measure the four most important microvascular determinants of tissue oxygen supply: arteriolar diameter, capillary density, tissue PO2, and hematocrit. Using the results of this study obtained at the microvascular level, muscle oxygen consumption was estimated to increase 9.8 fold with 1 Hz twitch contraction. Perfused muscle studies have found an increase of 8 fold with 1 Hz contraction. These results from microvascular and whole organ studies are remarkably close, indicating that the parameters chosen in this study as determinants of oxygen supply do in fact accurately reflect oxygen supply when considered collectively. Dissert. Abstr.

N80-18695 Missouri Univ. - Columbia.
CIRCADIAN RHYTHMICITY IN VENTRICULAR MYOCARDIAL AND DIAPHRAGMATIC METABOLISM Ph.D. Thesis
Susan Marie Garthwaite 1979 121 p
Avail: Univ. Microfilms Order No. 8002361

Circadian rhythm studies were utilized to elucidate metabolic mechanisms operative in ventricle and diaphragm of unstressed animals. Male Wistar rats were sampled after two weeks of entrainment to a 12L:12D light cycle in which the lights came on at 0600 hours and went off at 1800 hours. Food and water were available ad lib. Ventricular and diaphragmatic samples were obtained from each rat at 4 hour intervals during the 24 hour cycle. Weight of the stomach contents of the same rats was also determined as an index of food consumption. A circadian rhythm in ventricular glycogen was found with a peak at 0600 hours and a nadir at 1800 hours. Ventricular free fatty acid and triglyceride levels also showed a circadian rhythm, but 180 deg out of phase with the glycogen rhythm. A circadian rhythm of diaphragmatic glycogen was found with a peak value preceding the ventricular glycogen peak by about 4 hours. Other significant results are reported. Dissert. Abstr.

N80-18696 Arizona Univ., Tucson.
MUSCULAR FORCE-VELOCITY ALTERATIONS CONSEQUENT TO SLOW AND FAST VELOCITY POWER TRAINING Ph.D. Thesis
Edward Francis Coyle 1979 77 p
Avail: Univ. Microfilms Order No. 8003049

Muscular force-velocity alterations were compared to slow and fast velocity power training. Active males trained the knee extensors of both legs simultaneously for six weeks, three times per week, by attempting to generate maximal peak torque (MPT) with each repetition at velocities of 60 deg/sec (MPT/60), 300 deg/sec (MPT/300), or both. Fast training significantly improved MPT uniformly (16-21%) at the training velocity as well as at slower velocities. Only the MPT/180 and MPT/300 improvements contained a significant physiological component of adaptation. High tension producing contractions appear necessary to improve MPT/slow while fast training velocities must be employed to improve MPT/fast. Fast training improves MPT in the mid-velocities more effectively than does slow training. Dissert. Abstr.

N80-18697 Arizona Univ., Tucson.
MODELS OF HUMAN VISION IN DIGITAL IMAGE BANDWIDTH COMPRESSION Ph.D. Thesis
Douglas James Granrath 1979 181 p
Avail: Univ. Microfilms Order No. 8003051

The study of human vision is applied to the problem of reducing the amount of information necessary to represent an image. Relevant vision research is reviewed, including eye and retina anatomy, membrane potential recordings, and psychophysical studies. Current engineering models of human vision are discussed in terms of their structural similarities to the eye. A two-channel model of spatial interaction in the retina is then developed based on retinal cell structure and related experimental results. Analysis of this model shows that one of the channels carries mainly image contrast information while the other carries edge detail. Computer simulation results demonstrate a bandwidth reduction potential from 8 bits per pixel down to 2 bits per pixel for the model. Suggestions for further research include use of the two-channel model to predict image quality. Dissert. Abstr.

N80-18698 Lehigh Univ., Bethlehem, Pa.
MATHEMATICAL ANALYSIS OF CARBON DIOXIDE TRANSPORT BY BLOOD Ph.D. Thesis
Ramon Fayad 1979 191 p
Avail: Univ. Microfilms Order No. 8003061

A theoretical analysis of acid-base balance at the microcirculatory level is presented. A mathematical model that includes the physiological and biochemical processes important to carbon dioxide transport by blood is constructed. Using perturbation and time scale techniques to study the steady-state problem, analytic solutions are obtained for the cases when no change in saturation of hemoglobin occurs and when a linear decrease in oxygenation of blood from the arterial to the venous end of the capillary occurs. The extent to which the various processes contribute to carbon dioxide transport by blood is determined, and it is found that while the dependence of CO2 exchange on O2 (Haldane effect) accounts for 40% of carbon dioxide transport, the magnitude of the Bohr effect is rather small. Dissert. Abstr.

N80-18699 George Washington Univ., Washington, D. C.
CONTINUOUS REAL-TIME AUDITORY EVOKED POTENTIALS USING A SLIDING WINDOW OF AVERAGES Ph.D. Thesis
Nicholas Anthony Diakides 1979 195 p
Avail: Univ. Microfilms Order No. 8003453

Procedures and computer instrumentation which would advance the state of the art in auditory evoked response (AER) measurement, especially to alleviate the need for prolonged testing periods required by the traditional method of AER measurement were developed. The key to an improved method lay in the use of high rates of presentation of auditory stimuli, i.e., 20-50 Hz, and a means of continuously averaging and updating the output data (sliding window of averages). The high stimulus rates would allow more responses to be obtained and evaluated in a very short time, i.e., a few seconds. A clearly observable enhancement of AER amplitude was found at and around 45 Hz with correspondingly high signal-to-noise ratios (SNRs) when referenced to ongoing EEG background activity levels. Having demonstrated the fundamental phenomenon of AER and SNR enhancement at high stimulus frequencies, a low cost microcomputer system and operational algorithm were developed and successfully tested. Dissert. Abstr.

N80-18700 Wisconsin Univ. - Madison.
MASS TRANSFER STUDIES OF PULMONARY FUNCTION Ph.D. Thesis

Simon Hallifax Hobbs 1979 282 p
Avail: Univ. Microfilms Order No. 7928547

A comprehensive lung model was developed which takes into account both diffusion and ventilation distribution effects. Particlar emphasis was placed on the simulation of the pulmonary transport of insoluble inert gases, especially nitrogen, helium, and sulfur hexafluoride, which are commonly used in respiratory diagnostic testing. An expression was developed to describe individual lung unit alveolar gas concentrations, in terms of the most important lung parameters. The ventilation distribution found throughout the lung was the critical factor controlling gas concentration since it severely limited transport of gas into poorly ventilated lung regions. Dissert. Abstr.

N80-18701 Commission of the European Communities, Luxembourg.
THE RADIATION PROTECTION PROGRAM Annual Report, 1977
1978 798 p refs Partly in ENGLISH, FRENCH and GERMAN
(EUR-5972; ISBN-92-825-0184-1) Copyright. Avail: Issuing Activity

Five hundred seventy-four papers published as a result of research are presented under six headings. These are dosimetry, radioactive contamination of the environment, hereditary effects of ionizing radiation, somatic short-term effects of ionizing radiation, somatic long-term effects of ionizing radiation, and evaluation of radiation risks. Much research was undertaken into the damaging effects of radiation on chromosomes and other genetic material. Somatic effects of radiation in the induction of leukemia and carcinogenesis as well as the controlled use of radiation in the treatment of diseases were studied. The environmental impact of radiation on the water cycle and food chain are also covered. Author (ESA)

N80-18702# Royal Aircraft Establishment, Farnborough (England).
THE HUMAN BODY TEMPERATURE REGULATION SYSTEM
J. Werner Sep. 1979 24 p refs Transl. into ENGLISH from Biol. Cybernetics (West Germany), v. 17, 1975, p 53-63
(RAE-Lib-Trans-2019; BR71910) Avail: NTIS HC A02/MF A01

The control loop of human body temperature is treated as a distributed parameter system. The equations of heat balance are formulated, admitting discontinuities of parameters. Using two successive integral transformations and an expansion with eigenfunctions, an analytical solution is found for the closed control loop. Regarding the stationary as well as the dynamic behavior, the mathematical results are on the whole compatible with experimental results. K.L.

N80-18703# Materials Research Labs., Melbourne (Australia).
SIZE AND LUMINANCE DISCRIMINATION IN THE PERIPHERAL VISUAL FIELD
Stephen E. Jenkins Oct. 1979 28 p refs
(MRL-R-760; AR-001-843) Avail: NTIS HC A03/MF A01

The discrimination of length differences between two bars as well as size and luminance differences between two discs was measured as a function of the angle of eccentricity between the fixation point and the stimulus. The experiments provided basic data necessary for the interpretation of experiments involving the detection of discs embedded in a complex background which in turn elucidate the determinants of camouflage. It was found that: (1) discs are discriminated in size by virtue of their difference in diameter rather than their difference in area; (2) the 50% and 90% levels of detection probability of size and luminance contrast between two discs are linear functions of eccentricity at least to 14 deg eccentricity; (3) the visual system is better at discriminating size contrast at all eccentricities tested than it is at discriminating luminance contrast; and (4) there is a fundamental difference between the mechanisms which mediate size and luminance discrimination. K.L.

N80-18704*# National Aeronautics and Space Administration, Washington, D. C.
EXPERIMENTAL INVESTIGATION OF THE ROLE OF THYROCALCITONIN IN THE PROPHYLAXIS OF DISTURBANCES IN THE WATER-SALT AND MINERAL METABOLISM DURING A 30-DAY HYPOKINESIA
V. S. Shashkov, B. B. Yegorov, B. S. Dmitriyev, A. N. Volozhin, and B. P. Krotov Nov. 1979 10 p refs Transl. into ENGLISH from Fiz. Zh. SSSR (Moscow), v. 60, no. 2, 1974 p 290-294 Original language document was announced as A74-26557 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75938) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of thyrocalcitonin (TCT) injections on the metabolism of water and electrolytes in free-moving and immobilized chinchilla hares is described. Calcium excretion from immobilized animals was elevated, but normalized in those also receiving TCT injections. TCT also normalized water content and excretion rates. Author

N80-18705*# National Aeronautics and Space Administration, Washington, D. C.
RESTRAINT ULCERS IN THE RAT. 1: INFLUENCE ON ULCER FREQUENCY OF FASTING AND OF ENVIRONMENTAL TEMPERATURE ASSOCIATED WITH IMMOBILIZATION OF VARYING DURATIONS
L. Buchel and D. Gallaire Feb. 1980 16 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 21, 1967 p 527-536 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76031) Avail: NTIS HC A02/MF A01 CSCL 06S

The results of the production of experimental ulcers in rats are described. Two experimental conditions were found to regularly provoke the appearance of gastric ulcers in a high percentage of rats: (1) two-and-a-half hour restraint, proceeded by a 24 hour fast; and (2) one-and-a-half hour restraint with lowering of the environmental temperature while fasting. R.E.S.

N80-18706*# National Aeronautics and Space Administration, Washington, D. C.
HORMONE SUPPLY OF THE ORGANISM IN PROLONGED EMOTIONAL STRESS
M. G. Amiragova, B. V. Stulnikov, and R. I. Svirskaya Feb. 1980 15 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR I. M. Sechenova (USSR), v. 65, no. 7, 1979 p 945-952 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3198)
(NASA-TM-76046) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of prolonged emotional stress of varying genesis on the hormonal function of the pancreas, thyroid gland, and adrenal cortex was studied. The amount of the hormonal secretion was found to depend on the type of adaptation activity and its duration. High secretion of the hormones observed outside the adaptation activity was examined as an index of the phase transition of defense reactions to the phase of overstress. R.E.S.

N80-18707*# National Aeronautics and Space Administration, Washington, D. C.
PHYSIOLOGIC REACTIONS DURING FIVE WEEKS OF CONTINUOUS RESIDENCE IN AN ARTIFICIAL HUMID AND HOT CLIMATE
Ulrich Laaser Oct. 1979 24 p refs Transl. into ENGLISH from Int. Z. Angew. Physiol. (West Germany), v. 25, 1968 p 279-302 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Tuebingen Univ., West Germany
(Contract NASw-3199)
(NASA-TM-75356) Avail: NTIS HC A02/MF A01 CSCL 06S

During 5 weeks in a climatic room, total sweat during work almost doubled. Initial hour differences increasingly equalized. There was a displacement of sweat secretion from trunk to extremities till the end of week 3, occurring earlier and more clearly for the arm than for the leg. Work temperatures dropped rapidly and evenly to a constant level by day 11. Circulation behavior matched that of temperature. Pulse rate during work dropped like rectal temperature and pulse rate during rest was phasically like the pattern of corresponding temperatures. Except for the first days urine output was adequate and even, Na decreasing in the urine until week 3, then returning to initial values. Na and K in sweat declined but with opposite patterns for hours 1-4. Total salt elimination decreased. The conclusive phenomena of redistribution occurred within the first 3 weeks. A few functions changed later also. Relatively trivial changes in an otherwise uniform reaction pattern indicated that after 3 or even 5 weeks of acclimatization the process is not over or at least not completely so. The tempo of the process appears to be a function of the degree of loading. Author

N80-18708*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF HYPOKINESIA ON CONTRACTILE FUNCTION OF CARDIAC MUSCLE
F. Z. Meyerson, V. I. Kapelko, A. M. Trikhpoyeva, and M. S. Gorina Feb. 1980 12 p refs Transl. into ENGLISH from Kardiologiya (USSR), no. 2, Feb. 1979 p 71-76 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76061) Avail: NTIS HC A02/MF A01 CSCL 06S

Rats were subjected to hypokinesia for two months and the contractile function of isolated papillary muscle was studied. Hypokinesia reduced significantly the isotonic contraction rate which depended on the ATPase activity of the myofibrils; it also reduced the rate and index of relaxation which depended on the functional capacity of the Ca(+ +) pump of the sarcoplasmic reticulum. The maximum force of isometric contraction determined by the quantity of actomyosin bridges in the myofibrils did not change after hypokinesia. This complex of changes is contrary to that observed in adaptation to exercise when the rate of isotonic contraction and relaxation increases while the force of isometric contraction does not change. The possible mechanism of this stability of the contractile force during adaptation and readaptation of the heart is discussed. Author

N80-18709*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OBJECTIVE MEASUREMENT OF HUMAN TOLERANCE TO +G SUB Z ACCELERATION STRESS Ph.D. Thesis - Univ. of N. Indiana
Salvadore A. Rositano Washington Feb. 1980 100 p refs
(NASA-TM-81166; A-8059) Avail: NTIS HC A05/MF A01 CSCL 06S

The efficacy of a new objective technique using a transcutaneous Doppler flowmeter to monitor superficial temporal artery blood flow velocity during acceleration was investigated. The results were correlated with current objective and subjective G tolerance end points. In over 1300 centrifuge runs, retrograde eye level blood flow leading to total flow cessation was consistently recorded and preceded visual field deterioration leading to blackout by 3 to 23 seconds. The new method was successfully applied as an objective indication of tolerance in a variety of test situations including evaluation of g-suits, straining maneuvers, and 13 deg, 45 deg and 65 deg set back angles. R.E.S.

N80-18710*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COSMOS 81 US/USSR CARDIOVASCULAR STUDY: EXPERIMENT IMPLEMENTATION PLAN
John W. Hines Feb. 1980 14 p
(NASA-TM-81178) Avail: NTIS HC A02/MF A01 CSCL 06B

The experimental activities to be undertaken in the accomplishment of the Cosmos 81 Primate Study are discussed. A detailed description of the specific tasks to be performed, approaches, options, and tradeoffs to be considered, and personnel assigned is presented. The main project is to chronically instrument the carotid artery (flow, pressure) using Rhesus monkeys and interpret the results. R.E.S.

N80-18711*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF GRAVITATIONAL STRESS, HYPOKINESIA AND HYPODYNAMIA ON THE STRUCTURE OF THE VASCULAR BED OF THE SPLEEN
N. T. Nesterenko Feb. 1980 12 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. Embriol. (USSR), v. 64, no. 5, 1973 p 44-51 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by 1st Leningrad I. P. Pavlov, Medical Inst.
(Contract NASw-3199)
(NASA-TM-75934) Avail: NTIS HC A02/MF A01 CSCL 06S

The effects of two extreme factors, hypokinesia and hypodynamia, on spleen vascular beds were studied on 180 male and female albino rats. Vessels were studied by roentgenography, microroentgenography, clearing of sections and histology. Gravity stress yielded construction of all links of arterial bed and of order 5-7 veins. Large intraorganic vein diameters changed significantly but erratically. Hypokinesia in early phases produced pronounced spleen size reduction. Veins and arteries constricted along entire length. Later hypokinetic stages showed arteries still constricted; veins began to dilate from week 4 of hypokinesia. Sinuosity, uneven contours and varicose dilations of walls in large arteries and veins occurred. Abrupt changes in parenchyma, e.g., atrophy of folliculi, narrowing of lumen of central arteries from thickening of muscular wall. After exposure to hypokinesia followed by gravitational stress, pronounced lesions such as deformation of vascular wall, including rupture, in all vessels of the spleen vascular bed. R.E.S.

N80-18712# Interuniversitair Reactor Instituut, Delft (Netherlands).
[ACTIVITIES REPORT ON REACTOR PHYSICS, 1977 TO 1978] Annual Report [JAARVESLAG 1977-1978: AKADEMISCH JARR]
1979 107 p refs In DUTCH
Avail: NTIS HC A06/MF A01

The structure, staffing, budget, space allocation, and publications of the institute are described. The scientific activities include radiation and reactor physics, radiochemistry, dosimetry, and radiation hygiene. Author (ESA)

N80-18713# Southampton Univ. (England). Inst. of Sound and Vibration Research.
VIBRATION INJURIES OF THE HAND AND ARM: THEIR OCCURENCE AND THE EVOLUTION OF STANDARDS AND LIMITS
M. J. Griffin Jul. 1979 85 p refs
(Contract HSE-1653/45.09)
(ISVR-TR-101) Avail: NTIS HC A05/MF A01

Alternative methods of rating the serverity of vibration exposures for the hand and arm are compared. The difficulties associated with the formulation of useful vibration standards and limits are discussed and deficiencies in present standards are outlined. Specific recommendations concerning the formulation of standards and limits are offered. Desirable objectives for surveys of worker health, tool vibration characteristics, and working methods are defined. The need for reducing and isolating tool vibration is identified along with the importance of tool gripping methods. It is suggested that an improved understanding of the nature of vibration injuries and their symptoms is required.
Author (ESA)

N80-18714# Technische Hogeschool Twente, Enschede (Netherlands). Afdel. Elektrotechniek.
APPLICATION OF MUTUAL AMOUNT OF INFORMATION FOR TIME DELAY ESTIMATION Ph.D. Thesis
G. W. vanArragon 6 Aug. 1979 80 p refs Partly in ENGLISH and DUTCH
(THT-210) Avail: NTIS HC A05/MF A01

An estimate for the average mutual amount of information (AMAI) as a function of time delay between two time series was developed. This estimate is intended for analyzing the spread of an epileptic seizure through the cortical layers of the brain of an epileptic patient based on an ictal EEG recording. The theory of mutual amount of information is reviewed. It depends on the marginal and joint probability densities of two time series. An estimator for the joint (bi-variate) density is proposed and compared with estimators described in the literature. Results show that the proposed estimator is the best for practical AMAI estimation. A computer algorithm for AMAI estimation was derived and its behavior studied using test data. Promising results lead to its inclusion in an interactive FORTRAN program which is

available as part of an EEG analysis library for special purposes.
Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-18715 California School of Professional Psychology, Los Angeles.
THE POWER PROCESS: A SYNTHESIS THEORY OF POWER Ph.D. Thesis
Steven Howard Graubard 1979 418 p
Avail: Univ. Microfilms Order No. 8003230

A series of studies designed to test the process approach to power is offered. In order to describe the power process adequately, a blend of phenomenological and empirical methods is suggested. Phenomenological techniques are expected to yield subjects' descriptions, thoughts and feelings associated with power related experiences. This data is analyzed for thematic content as it relates to each of the four power process components and compared with data obtained from empirical measures. Experimental situations, including small group interactions, individual tasks, experimental descriptions, and specific psychological tests, are suggested. Implications for future research are discussed.
Dissert. Abstr.

N80-18716# Research Inst. of National Defence, Linkoeping (Sweden).
PILOT SELECTION USING PSYCHOLOGICAL METHODS [URVAL AV FLYGFOERARE MED PSYKOLOGISKA METODER]
Leif Carlstedt Mar. 1979 62 p refs In SWEDISH
(FOA-C-55024-H7) Avail: NTIS HC A04/MF A01

The use of psychological methods in military aircraft pilot selection is surveyed, covering the period from World War 1 to 1979. The methods of analysis used have different starting points, stressing either the man or the function characteristics. A multiple regression statistical evaluation model is most frequently used resulting in some compensation of psychological characteristics. No examples of normative evaluation models were found in recent pilot selection methods.
Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-18717 Arizona State Univ., Tempe.
MODELING REQUIREMENTS FOR NETWORK SIMULATION OF HUMAN-MACHINE SYSTEMS Ph.D. Thesis
Gayle Lynn Berry 1979 335 p
Avail: Univ. Microfilms Order No. 8003862

A critical review of eight task taxonomies was performed. Each taxonomy was ranked against a set of criteria which were developed to select for usefulness in modeling human machine systems. The standard task analysis procedure was revised so that all information required for a network computer simulation of a human machine system would be produced. The two highest ranking task taxonomies were used in the task analysis procedure to model a test case human machine system. A SAINT computer simulation was performed for each of the two resulting models. For each simulation model, both Normal and Weibull distributions were used in four different combinations to represent human task performance time. In order to make it possible to use the Weibull distribution when no sample data were available, a method was developed to derive the Weibull parameters for shape and scale from an estimated mean and standard deviation.
Dissert. Abstr.

N80-18718*# Rockwell International Corp., Canoga Park, Calif.
STS MISSION DURATION ENHANCEMENT STUDY: (ORBITER HABITABILITY) Final Report
A. D. Carlson Dec. 1979 145 p
(Contract NAS9-15903)
(NASA-CR-160535; SOD-79-0321) Avail: NTIS HC A07/MF A01

Habitability improvements for early flights that could be implemented with minimum impact were investigated. These included: (1) launching the water dispenser in the on-orbit position instead of in a locker; (2) the sleep pallet concept; and (3) suction cup foot restraints. Past studies that used volumetric terms and requirements for crew size versus mission duration were reviewed and common definitions of key habitability terms were established. An accurately dimensioned drawing of the orbiter mid-deck, locating all of the known major elements was developed. Finally, it was established that orbiter duration and crew size can be increased with minimum modificattion and impact to the crew module. Preliminary concepts of the aft med-deck, external versions of expanded tunnel adapters (ETA), and interior concepts of ETA-3 were developed and comparison charts showing the various factors of volume, weight, duration, size, impact to orbiter, and number of sleep stations were generated. R.E.S.

N80-18719# School of Aerospace Medicine, Brooks AFB, Tex.
A NEW ANTI-G VALUE FOR HIGH-PERFORMANCE AIRCRAFT Final Report, 1 Jan. 1977 - 1 Jan. 1979
Russell R. Burton, Robert M. Shaffstall, Jamy L. Jaggars, Kent K. Gillingham, and Kennith W. Stevens Nov. 1979 25 p
(AF Proj. 7930)
(AD-A076904; SAM-TR-79-27) Avail: NTIS HC A02/MF A01 CSCL 22/1

The USAF School of Aerospace Medicine (USAFSAM) Crew Technology Division has developed an advanced anti-G valve for pressurizing the anti-G suit during exposures to acceleration. The anti-G valve presently in fighter aircraft has been determined to operate too slowly for rapid onset of G, potentially causing pilots of high-performance aircraft to black out, lose consciousness, and/or become fatigued. The time relationship to G-suit pressurization using the conventional anti-G valve was found to be sigmoidal, having two relatively slow pressurization phases--one early, and the other late--in the suit-inflation schedule. Elimination of these two slow phases were accomplished by: (1) preinflating the anti-G suit to 0.2 psi prior to an increase in G (called 'Ready Pressure'), and (2) increasing the capacity of air flow through the anti-G valve (called 'Hi-Flow'). The development of the Hi-Flow Ready Pressure (HFRP) anti-G valve by USAFSAM increased in the rate of G-suit pressurization threefold. This HFRP anti-G valve was tested on eight F-15 pilots, using the centrifuge at the Naval Air Development Center, Warminster, Pa. A comparison of this experimental valve with the conventional anti-G valve (presently operational in the F-15 aircraft) resulted in a high degree of pilot acceptance, because the HFRP valve had better valve response, reduced valve error scores, and allowed the pilots to tolerate high-G exposures with less effort. GRA

N80-18720# Research Inst. of National Defence, Stockholm (Sweden).
PROTOTYPE: PRELIMINARY STUDY ON EMERGENCY BREATHING APPARATUS [FRISKLUFTHJAELM 1 PROTOTYP. FOERSTUDIUM]
Tage Berglund Jun. 1979 17 p In SWEDISH
(FOA-C-40103-C2) Avail: NTIS HC A02/MF A01

Some developmental alternatives for the protection helmet M-51 are discussed in terms of military aircraft application. A helmet prototype is described, including four complete mask alternatives. It is concluded that all four designs and the helmet prototype are acceptable, but improvements are necessary in all cases.
Author (ESA)

N80-18721# Research Inst. of National Defence, Stockholm (Sweden).
SUGGESTIONS FOR THE CONTENTS OF THE AVIATION BOARD SURVIVAL KIT [FOERSLAG TILL INNEHAALL I FV NOEDUTRUSTNINGSPACKE]
Ove Wilson, Christer Spaangberg, and Bo Ekberger Aug. 1979 56 p refs In SWEDISH
(FOA-A-59004-H3(H9)) Avail: NTIS HC A04/MF A01

Survival equipment for aircrews operating over land and sea in arctic climates is described. Survival techniques are discussed in relation the contents of a proposed survival kit, including the requirements for protection from the elements, food and water, signaling, first aid, and weapons. The various kit materials are either attached to the life jacket, the flight suit, the life raft, or are found in a separate container. Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N80-18722* Systems Technology, Inc., Mountain View, Calif.
THE ANALYSIS OF DELAYS IN SIMULATOR DIGITAL COMPUTING SYSTEMS. VOLUME 2: FORMULATION OF DISCRETE STATE TRANSITION MATRICES, AN ALTERNATIVE PROCEDURE FOR MULTIRATE DIGITAL COMPUTATIONS Final Report
Warren F. Clement and Wayne F. Jewell Feb. 1980 44 p refs
(Contract NAS2-10106)
(NASA-CR-152341; STI-TR-1140-1-Vol-2) Avail: NASA. Ames Res. Center, Moffett Field, Calif. 94035 CSCL 09B

The effects of spurious delays in real time digital computing systems are examined for the two-computer, multirate problem. A transition matrix which combines the computational algorithms and multirate effects is formulated. Some examples are provided which demonstrate the analysis approach and suggest applications. K.L.

N80-18723 Syracuse Univ., N. Y.
RELACS, AN ASSOCIATIVE COMPUTER ARCHITECTURE TO SUPPORT A RELATIONAL DATA MODEL Ph.D. Thesis
Ellen Jane Oliver 1979 418 p
Avail: Univ. Microfilms Order No. 8004513

The problem of implementing a relational data model on a computer system designed expressly for that purpose is discussed. A proposed computer architecture for a relational associative computer system, (RELACS), is introduced. It is shown that the proposed system is capable of supporting many functions of a data base management system. Timing equations are developed to describe the operation of RELACS for retrieval, deletion, modification and addition. These equations are utilized to examine the behavior of RELACS when relation cardinality, associative array memory (AAM) size, the number of attributes in the query and the number of relations in the query are varied. Results indicate that the larger the AAM up to a maximum of the relation cardinality, the faster was the processing. The AAM size is affected by the speed and cost requirements of the Data base management system as well as the expected relation cardinality. It was also found that the time to process a query increases as the number of attributes and/or relations is increased. Dissert. Abstr.

N80-18724 University of Southwestern Louisiana, Lafayette.
A MATHEMATICAL MODEL FOR A VIRTUAL MACHINE MONITOR AND ITS SUPPORTIVE STRUCTURE Ph.D. Thesis
Duc Tan Nguyen 1979 174 p
Avail: Univ. Microfilms Order No. 8002711

A functional mathematical model is developed for a virtual machine monitor (VMM) on either uniprocessor or distributed processor support systems. The support systems should have a monostate architecture or should be dynamically microprogrammable so that they can emulate such an organization. Five studies are undertaken in the research: (1) an examination of the capability of existing dataflow languages to describe operating systems, in particular, to model VMM functions, (2) an investigation of a specific VMM and its support architecture to be used as a basis for the research, (3) the construction of an abstract dataflow model for the selected structure, (4) the formalization of the relationship between elements of the VMM and its support architecture using algebraic and functional relations, and (5) a demonstration that the abstract dataflow model exhibits the same behavior as does the base structure. Dissert. Abstr.

N80-18725 Illinois Univ. at Urbana-Champaign.
TEST GENERATION FOR MICROPROCESSORS Ph.D. Thesis
Satish Mukund Thatte 1979 172 p
Avail: Univ. Microfilms Order No. 8004286

Test generation procedures for testing microprocessors in a user environment are developed. A general graph-theoretic model for microprocessors is developed at the register transfer level. Any microprocessor can be easily modeled using information only about the instruction set and the functions performed by it. A fault model is developed on a functional level quite independent of the implementation details. The effects of faults in the fault model are investigated at the level of the graph theoretic model. Test generation procedures are proposed which take the microprocessor organization and the instruction set as parameters and generate tests to detect all the faults in the fault model. The complexity of the test sequences measured in terms of the number of instructions is given. Efforts in generating tests for a real microprocessor and evaluating their fault coverage are described. Dissert. Abstr.

N80-18726 Oklahoma State Univ., Stillwater.
OPTIMAL DISTURBED MICROPROCESSOR ARCHITECTURE USING MULTI-PHASE PROCESSING TO PERFORM A VECTOR, MATRIX MULTIPLICATION Ph.D. Thesis
Larry Gene Stotts 1979 150 p
Avail: Univ. Microfilms Order No. 8003605

The application of optimal design criteria to the implementation of an array processor is explored. The algorithm and the hardware are simultaneously taken into account in the design process in an attempt to combine as many steps as possible in the design sequence. The algorithm of a vector, matrix product is utilized since it forms the operational bases of linear recursive filtering and similar practical engineering computations. The design is minimized to system cost and constrained to time of completion, system power consumption, and system circuit board area. The concept of optimization is used at a modular level and at a circuit design level in an attempt to optimize the system throughout. Dissert. Abstr.

N80-18727 Oklahoma Univ., Norman.
DATA DETECTION IN HIGH DENSITY DIGITAL MAGNETIC RECORDING Ph.D. Thesis
Hossein Mohamad Moghadam 1979 153 p
Avail: Univ. Microfilms Order No. 8003803

A generalized read system which combines several features in order to significantly increase probability of detection is designed. Signal equalization in conjunction with a peak-follower qualifying channel, followed by a phase coherent matched filter are the key elements of the design. The concept of a real time majority decoder, in the block diagram form, is introduced and

discussed. This concept utilizes three differently processed channels resulting in a certain degree of uncorrelation among them. The outcome is determined by a majority decode logic.
Dissert. Abstr.

N80-18728# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 4: CHARTING SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
J. Late and A. DiPasqua Sep. 1979 45 p refs 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076107; RADC-TR-79-179-Vol-4) Avail: NTIS HC A03/MF A01

The requirements, functional design, and operational considerations of the Automated Air Information Production System charting subsystem are presented. The charting subsystem provides capture, revision, and output of graphic data appearing throughtout the Defense Mapping Agency Aerospace Center flight information publications. The data are presented in digital form and techniques are provided to simplify alteration of the data.
J.M.S.

N80-18729# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 5: CARTOGRAPHIC EBR SYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
Sep. 1979 41 p refs 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076108; RADC-TR-79-179-Vol-5) Avail: NTIS HC A03/MF A01 CSCL 05/2

The design, fabrication, installation and testing an advanced large format, electron beam recorder for the production of computer generated master recordings on film is reported. Flight information products produced include: enroute high altitude charts; enroute low altitude charts; low altitude instrument approach procedure books; high altitude instrument approach procedure books; low altitude instrument departure procedure books; high altitude instrument departure procedure books; IFR supplements; VFR supplements; general planning books; area planning books; and area planning - special use airspace books.
J.M.S.

N80-18730# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
N. Bottini and P. Nash Sep. 1979 65 p refs 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076104; RADC-TR-79-179-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 05/2

An automated system designed to reduce the manual labor required for the revision and publication of information critical to flight operations and logistical planning is described. Response time between receipt of changes to air navigation/air facilities data and the dissemination of that data to all users is also improved.
J.M.S.

N80-18731# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 2: PUBLISHING SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
S. Edelblum and S. Bowden Sep. 1979 145 p refs 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076105; RADC-TR-79-179-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 05/2

An automated system developed to provide information critical to flight operations and logistical planning is described. The publishing subsystem permits publications to be produced on electronic equipment and extends the power and flexibility of digital manipulation to the updating and reformating of publications.
J.M.S.

N80-18732# Synectics Corp., Rome, N. Y.
AUTOMATED AIR INFORMATION PRODUCTION SYSTEM, PHASE 1. VOLUME 3: AIR FACILITIES SUBSYSTEM Final Technical Report, 26 Apr. 1977 - 26 Jul. 1978
W. Nehl and P. Moulder Sep. 1979 134 p refs 5 Vol.
(Contract F30602-77-C-0065)
(AD-A076106; RADC-TR-79-179-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 05/2

The requirements, functional design, and operational considerations of the Automated Air Facility Information File (AAFIF) are presented. The air facilities subsystem provides maintenance of the AAFIF data bases, selective data base retrieval, special report generation, and generation of formatted tape files for film negative output.
J.M.S.

N80-18733# Aeronautical Research Labs., Melbourne (Australia).
A MICROPROCESSOR CONTROLLED PROM PROGRAMMER
C. W. Sutton Feb. 1979 41 p
(AD-A073154; ARL/Aero-TM-313) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a microprocessor controlled PROM programmer with user options to program, list and copy the memory content of MM5204Q devices.
GRA

N80-18734# Electronics Research Lab., Adelaide (Australia).
MANAGEMENT PROCEDURES FOR CONTROLLING DATA STORAGE ON THE IBM SYSTEM 370 COMPUTER AT DRCS
J. C. Gwatking and R. W. Collier Jan. 1979 34 p
(AD-A076139; ERL-0055-TR) Avail: NTIS HC A03/MF A01 CSCL 05/2

This document is one of a series describing various aspects of data management on the DRCS Central Computer. It includes methods for controlling user datasets on both disk and magnetic tape. Where appropriate, the operating procedures and supporting software are also outlined.
GRA

N80-18735# Wisconsin Univ. - Madison. Mathematics Research Center.
THE DESIGN AND IMPLEMENTATION OF A DATABASE MANAGEMENT SYSTEM USING ABSTRACT DATA TYPE
A. James Baroody, Jr. and David J. DeWitt Jun. 1979 57 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-78-01721)
(AD-A077101; MRC-TSR-1970) Avail: NTIS HC A04/MF A01 CSCL 05/2

The design, implementation, and performance analysis of a database management system implemented using abstract data types are presented. The use of abstract data types as an implementation tool is shown to have several significant advantages over current implementation techniques. First, by using a combination of abstract data types and generic procedures to structure the design of a database system, the resulting software will be more reliable. Also, by employing a programming language which supports specification and verification of abstract data types, we can guarantee data independence. Finally, we demonstrate that the application of abstract data types permits the elimination of run-time interpretation of the schema and subschema such as in IBM's IMS, Univac's DMS110, and INGRES. Instead, the data manipulation routines, which are shown to be examples of generic procedures, are implemented as parameterized calls to the procedures bound to the instances of the three abstract data types used to represent the logical structure of the database.
GRA

N80-18736# National Technical Information Service, Springfield, Va.
COMPUTER PERFORMANCE EVALUATION. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - Nov. 1979
Brian Carrigan Dec. 1979 248 p Supersedes NTIS/PS-78/1078; NTIS/PS-77/0938; NTIS/PS-76/0830; NTIS/PS-75/753; NTIS/PS-75/063
(PB80-802085; NTIS/PS-78/1078; NTIS/PS-77/0938; NTIS/PS-76/0830; NTIS/PS-75/753; NTIS/PS-75/063) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites research on the measurement of computer systems effectiveness. It includes studies on workload determination, computational efficiency, and techniques for performance evaluation of both hardware and software. This updated bibliography contains 268 abstracts, 79 of which are new entries to the previous edition.
GRA

N80-18737# National Technical Information Service, Springfield, Va.
DATA COMPRESSION, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Nov. 1979
Brian Carrigan Dec. 1979 96 p Supersedes NTIS/PS-78/1248; NTIS/PS-77/1130; NTIS/PS-76/0996
(PB80-801657; NTIS/PS-78/1248; NTIS/PS-77/1130; NTIS/PS-76/0996) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography of worldwide journal literature cites research on techniques and equipment for data compression. Reports on video communications, data management, and computer storage devices are included. This updated bibliography contains 90 abstracts, 58 of which are new entries to the previous edition. GRA

N80-18738# National Technical Information Service, Springfield, Va.
DATA COMPRESSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Nov. 1979
Brian Carrigan Dec. 1979 192 p Supersedes NTIS/PS-78/1247; NTIS/PS-77/1129; NTIS/PS-76/0995; NTIS/PS-75/860; NTIS/PS-75/067
(PB80-801632; NTIS/PS-78/1247; NTIS/PS-77/1129; NTIS/PS-76/0995; NTIS/PS-75/860; NTIS/PS-75/067) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites Government-sponsored research studies on techniques and equipment for data compression. Reports are included on video communications, telemetry, voice communications, data management, and computer storage devices. This updated bibliography contains 234 abstracts, 16 of which are new entries to the previous edition. GRA

N80-18071*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GCF-NOCC RECONFIGURATION
J. P. McClure *In its* The Deep Space Network 15 Feb. 1980 p 86-89 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-18739 Massachusetts Univ., Amherst.
FORMAL METHODS AND HUMAN FACTORS IN THE DESIGN OF INTERACTIVE LANGUAGES Ph.D. Thesis
Andrew Jay Singer 1979 202 p
Avail: Univ. Microfilms Order No. 8004989

An approach to the design of interactive languages is presented which focuses on the problems of human engineering and complete definition for these languages. First, an approach which stresses user concerns and employs a detailed rationale to provide a basis for extracting human factors data is demonstrated in the design of an interactive 'assistant' for PASCAL programmers. Then, a method for completely describing interactive languages is developed in which interactive behavior is described using transition diagrams augmented by a semi-formal notation inspired by production systems. Finally, the framework of a complete semi-formal definition for the assistant is presented. The approach stresses the importance of details in the design process. Dissert. Abstr.

N80-18740 Carnegie-Mellon Univ., Pittsburgh, Pa.
SYMBOLIC EXECUTION OF FORMAL MACHINE DESCRIPTIONS Ph.D. Thesis
John Denniston Oakley 1979 168 p
Avail: Univ. Microfilms Order No. 7925022

The noteworthy problems of machine symbolic execution were investigated. A rigorous method was developed for symbolically evaluating algebraic-like expressions defined over the domain of variable length bit strings. A mixed integer/bit string representation was devised which permitted the elimination of superfluous bit lengths (by conversion to an integer valued expression); non-superfluous bit lengths were represented explicitly. A formal proof was given of the equivalence of this mixed representation with the original. Appropriate simplification techniques were introduced. Other accomplishments and observations as well as the results are reported. Dissert. Abstr.

N80-18741 Massachusetts Univ., Amherst.
STUDIES IN IMAGE SEGMENTATION ALGORITHMS BASED ON HISTOGRAM CLUSTERING AND RELAXATION Ph.D. Thesis
Paul Alexander Nagin 1979 179 p
Avail: Univ. Microfilms Order No. 8004968

The algorithms and structures that are sufficient to generate an accurate description of the information contained in a relatively complex class of digitized images are discussed. Some of the problems typically encountered in segmentation are explored. An algorithm is presented that avoids most of these problems. A series of computer generated test images with known characteristics are reported. Segmentation algorithms of varying degrees of complexity are applied to each image and their performance is carefully evaluated. It is shown that even the most sophisticated algorithms often perform poorly when confronted with certain apparently simple images. It is also shown that techniques which rely on histogram clustering often generate gross segmentation errors due to overlap in the distributions of the individual objects in a scene. Dissert. Abstr.

N80-18742 Syracuse Univ., N. Y.
LINEAR AND ALMOST-LINEAR METHODS FOR THE UNIFICATION OF FIRST ORDER EXPRESSIONS Ph.D. Thesis
Neil Vincent Murray 1979 137 p
Avail: Univ. Microfilms Order No. 8004511

Two techniques for rapid construction of stable equivalence relations are discussed. These techniques give rise to two classes of algorithms, having almost-linear and linear complexity. A published linear algorithm is shown to be incorrect and possibly not linear, and a correct linear algorithm is given. It is shown that the almost-linear algorithms can operate on graphs having fewer directed arcs than graphs suitable for linear algorithms. An interesting development arising from the study of equivalence handling is that under certain restrictions the equivalence problem can be done in linear time and space. The two abstract algorithms discussed were implemented in ALGOL W. Brief experiments conducted to compare their running times showed that the almost-linear algorithm runs faster than the linear one throughout the entire range of input sizes generated. Dissert. Abstr.

N80-18743 Syracuse Univ., N. Y.
ANALYSIS OF FUTURE EVENT SET ALGORITHMS FOR DISCRETE EVENT SIMULATION Ph.D. Thesis
William Michael McCormack 1979 271 p
Avail: Univ. Microfilms Order No. 8004510

The analytical and empirical results for the performance of algorithms proposed to implement the future event set in discrete event simulation are reported. These results provide a clear insight to the factors affecting algorithm performance; permit evaluation of the hold model often used to study future event set algorithms; and determine the best algorithm(s) to use. A number of theorems are given on the effect that scheduling distributions have on performance. A classification of distributions is established for efficient insertion scanning of a linear structure. The most significant results concern the effect of more than one scheduling distribution being present, as is typical of most simulations. Dissert. Abstr.

N80-18744 University of Southwestern Louisiana, Lafayette.
METHODS OF COMPACTING MICROPROGRAMS Ph.D. Thesis
Patrick Wayne Mallett 1979 188 p
Avail: Univ. Microfilms Order No. 8002714

The problem of reducing the number of microinstructions within a given microprogram for a horizontal microprogrammed processor was examined. Several results were obtained which include: specification and successful implementation of a machine independent model of microoperations and microinstructions; specification of metrics which can form a basis for evaluating various methods of compacting microprograms; successful extension and implementation of three algorithms, proposed in the literature, to accept input of microoperations specified in terms of the machine independent model; the design and implementation of a systems implementation language translation system which generates compacted microcode, equivalent to an input high level source program. Other significant results are reported. Dissert. Abstr.

N80-18745 Florida Univ., Gainesville.
A GENERALIZED SYSTEM FOR APPLICATION PROGRAM CONVERSION TO ACCOUNT FOR DATABASE SEMANTIC CHANGES: DESIGN AND PROTOTYPE IMPLEMENTATION Ph.D. Thesis
Herman Lam 1979 201 p
Avail: Univ. Microfilms Order No. 8002872

The effect on the application programs as a result of the database changes in the associated database was studied. A methodology of program analysis and conversion to account for the database changes is presented. Topics covered include: (1) the methodology; (2) a model of application program conversion; (3) an analysis of access patterns in the context of a semantic data model; (4) the possible meaningful semantic changes and their transformation rules for program conversion; (5) prototype implementation of the conversion phase; (6) the major interfaces to the conversion phase; and (7) the problems for future investigation. Dissert. Abstr.

N80-18746 Ohio State Univ., Columbus.
COMPUTATIONAL COMPLEXITY OF REAL FUNCTIONS AND POLYNOMIAL TIME APPROXIMATIONS Ph.D. Thesis
Ker-I Ko 1979 181 p
Avail: Univ. Microfilms Order No. 8001765

Recursive analysis, the theory of computation of functions on real numbers, was studied from various aspects. The computational complexity of real functions using the methods of recursive function theory was investigated. Partial recursive real functions were defined and their domains were characterized as the recursively open sets. The time complexity of recursive real continuous functions were defined and it is shown that the time complexity and the modulus of uniform continuity of a function are closely related. The complexity of the roots and the differentiability of polynomial time computable real functions were studied. The concept of nondeterministic computation was used to study the complexity of the integrals and the maximum values of real functions. Dissert. Abstr.

N80-18747 University of Southwestern Louisiana, Lafayette.
A METHODOLOGY FOR FREE FORMAT SYSTEMS DESIGN Ph.D. Thesis
Edwin David Hoover 1979 242 p
Avail: Univ. Microfilms Order No. 8002713

A system that implements a free form methodology is presented that provides an analyst with an automated technique designed specifically for the planning and design phase. The system utilizes a top down, structured approach comprised of a feasibility phase, detail design phase, and a task specifications phase. The system insures that the design is consistent with management's established objectives and that the individual tasks mesh to obtain the desired goals. Results indicate that with little or no training any analyst may begin using the system. Dissert. Abstr.

N80-18748 Cornell Univ., Ithaca, N. Y.
TOPICS IN COMPUTATIONAL COMPLEXITY Ph.D. Thesis
Steven Jonathan Fortune 1979 130 p
Avail: Univ. Microfilms Order No. 8003924

The problem of determining a homeomorphic embedding of a pattern graph in a target graph is described. The case where both pattern and target graphs are directed is considered. For pattern graphs which are essentially trees of height one, a polynomial time algorithm is given; for all other pattern graphs the problem is NP-complete. The problem of determining the two closest of n points, where the points are given by their coordinates in a k-dimensional Euclidean space is stated and it is shown that there is an obvious O(n2) algorithm for the problem: compare every pair of points. The termination properties for languages with various type structures are evaluated using versions of the gamma-calculus. The independence result for the polymorphic programming language is a consequence of the ability to represent in the polymorphic gamma-calculus all the computable functions which are provably recursive in Peano Arithmetic. Dissert. Abstr.

N80-18749*# National Aeronautics and Space Administration, Washington, D. C.
PROGRAMS FOR HIGH-SPEED FOURIER, MELLIN AND FOURIER-BESSEL TRANSFORMS
D. K. Ikhabisimov, A. S. Debabov, B. I. Kolosov, and D. A. Usikov Sep. 1979 19 p refs Transl. into ENGLISH of "Programmy Bystrykh Preobrazovaniy Fur'ye Mellina i Fur'ye-Besselya", Rept. Pr-418 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 17 p Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75678; Pr-418) Avail: NTIS HC A02/MF A01 CSCL 09B

Several FORTRAN program modules for performing one-dimensional and two-dimensional discrete Fourier transforms, Mellin, and Fourier-Bessel transforms are described along with programs that realize the algebra of high speed Fourier transforms on a computer. The programs can perform numerical harmonic analysis of functions, synthesize complex optical filters on a computer, and model holographic image processing methods. K.L.

N80-18750*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRAPHICS AND COMPOSITE MATERIAL COMPUTER PROGRAM ENHANCEMENTS FOR SPAR
Gary L. Farley (Army Research and Technol. Labs., Hampton, Va.) and Donald J. Baker (Army Research and Technol. Labs., Hampton, Va.) Feb. 1980 51 p refs
(NASA-TM-80209) Avail: NTIS HC A04/MF A01 CSCL 09B

User documentation is provided for additional computer programs developed for use in conjunction with SPAR. These programs plot digital data, simplify input for composite material section properties, and compute lamina stresses and strains. Sample problems are presented including execution procedures, program input, and graphical output. K.L.

N80-18751*# Texas Univ. at Austin. Inst. for Computing Science and Computer Applications.
DESIGN OF A VERIFIABLE SUBSET FOR HAL/S Final Report
James C. Browne, Donald I. Good, Anand R. Tripathi, and William D. Young 31 Dec. 1979 264 p
(Contract NAS9-13864)
(NASA-CR-162614) Avail: NTIS HC A12/MF A01 CSCL 09B

An attempt to evaluate the applicability of program verification techniques to the existing programming language, HAL/S is discussed. HAL/S is a general purpose high level language designed to accommodate the software needs of the NASA Space Shuttle project. A diversity of features for scientific computing, concurrent and real-time programming, and error handling are discussed. The criteria by which features were evaluated for inclusion into the verifiable subset are described. Individual features of HAL/S with respect to these criteria are examined and justification for the omission of various features from the subset is provided. Conclusions drawn from the research are presented along with recommendations made for the use of HAL/S with respect to the area of program verification. A.W.H.

N80-18752# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
PORTABILITY OF LARGE COBOL PROGRAMMERS: THE COBOL PROGRAMMER'S WORKBENCH Final Technical Report, 25 Nov. 1976 - 30 Jun. 1979
P. H. Enslow Sep. 1979 286 p refs
(Grant DAAG29-77-G-0045)
(AD-A076917; GIT-ICS-79-09; ARO-14752.1-A-EL) Avail: NTIS HC A13/MF A01 CSCL 09/2

The COBOL Programmer's Workbench is a fully integrated collection of automated software tools designed to substantially aid in the design, implementation, test, and maintenance of COBOL data processing systems, especially those that must run on a variety of target host operating environments. The Workbench also assists in the preparation and maintenance of all supporting documentation. One of the most important capabilities of the Workbench is the automatic preparation of a set of equivalent but compiler-unique versions of a baseline program that has been written in Workbench COBOL. The research here included an investigation of the problems of converting a baseline program into compiler-unique versions, an initial study of the use of reuseable modules in-line COBOL code, a limited feasibility demonstration of these capabilities, and a preliminary study for the design of COBOL. GRA

N80-18753# Human Resources Research Organization, Alexandria, Va.
STUDY OF SYMBOLOGY FOR AUTOMATED GRAPHIC DISPLAYS Technical Report, 11 May 1977 - 11 May 1978
Peter W. Hemingway, Albert L. Kubala, and Garvin D. Chastain May 1979 65 p refs
(Contract DAHC19-75-C-0025; DA Proj. 2Q7-63743-A-775)
(AD-A076916; HUMRRO-FR-WD-TX-78; ARI-TR-79-A18) Avail: NTIS HC A04/MF A01 CSCL 05/8

The primary purpose of this report is to describe the current status of symbology development for use in interactive graphic display systems such as the Command and Control Interactive Display Experimentation System (CCIDES). A secondary purpose is to examine user requirements for such systems when employed as a part of a Tactical Operations System (TOS). An extensive literature survey indicated a great variety of available alternative symbology formats. Before a specific format is selected, the necessary information requirements for a particular position must be determined. For Army tactical displays, this information should be gathered in experiments using realistic battle scenarios. As a related effort, alternative symbol formats were evaluated by civilians. Naive subjects generally preferred a pictorial symbol over traditional military alternatives. The report is written for a military audience. GRA

N80-18754# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A COLUMN GENERATION TECHNIQUE FOR THE COMPUTATION OF STATIONARY POINTS
Jong-Shi Pang Oct. 1979 30 p refs
(Contract N00014-75-C-0621)
(AD-A076415; MSRR-447; WP-29-79-80) Avail: NTIS-HC A03/MF A01 CSCL 12/1

In two recent papers, Eaves showed that Lemke's algorithm can be used to compute a stationary point of an affine function over a polyhedral set. This paper proposes an alternative method which is based on parametric principal pivoting. The proposed method involves solving systems of linear equations and parametric linear subprograms over the given polyhedral set. An obvious advantage of the method is that any special structure of the polyhedral set can be exploited profitably in the solution of the subprograms. GRA

N80-18755# Stanford Univ., Calif. Dept. of Operations Research.
DOCUMENTATION OF A COMPUTER PROGRAM FOR THE BOUND-AND-SCAN ALGORITHM FOR INTEGER LINEAR PROGRAMMING
Nancy F. Jacqmin Jul. 1979 90 p refs
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A075811; TR-87) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report gives documentation for the computer code BDSCAN for solving integer linear programming problems using the bound-and-scan algorithm. A listing of the program with sample input and output is included. GRA

N80-18756# Army Engineer Topographic Labs., Fort Belvoir, Va.
A WEIGHTED LINE-FINDING ALGORITHM
K. Abdoshah and A. Klinger Sep. 1979 25 p refs
(AD-A076112; ETL-0200) Avail: NTIS HC A02/MF A01 CSCL 09/4

This paper introduces two new algorithms to detect a line in a digitized picture. The algorithms are compared with the Hough algorithm, and their computational advantages are shown. We discuss the potential for, and the use of, the algorithms in applications, including the use of imagery in digital cartography. GRA

N80-18757# Yucca International, Inc., Scottsdale, Ariz.
SOFTWARE DEVELOPMENT, ITEM 0005 OF MICROPROCESSOR-BASED POWER CONDITIONER CONTROLLER
Feb. 1979 51 p refs
(Contract DAAK70-78-C-011)
(AD-A076118) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report describes the efforts to develop a microprocessor-based controller for the Delco 15KW power conditioner. Continuing from the hardware development, the previous task, the software necessary to perform voltage regulation of the converter section was developed. The assembled program was executed and debugged using the simulation capability provided. GRA

N80-18758# California Univ., Davis. Signal and Image Processing Lab.
APPLICATIONS OF STOCHASTIC MODELS FOR IMAGE DATA COMPRESSION
Sheng-Huey Wang (Picker Corp., Mayfield Village, Ohio) and Anil K. Jain Sep. 1979 257 p refs
(Grant DAAG29-78-C-0206)
(AD-A078781; ARO-16222.3-EL) Avail: NTIS HC A12/MF A01 CSCL 09/4

Intraframe image data compression systems are analyzed in this thesis using stochastic modeling concepts. The formulations of stochastic image models are obtained from different classes of partial differential equations. Their application to the coding problem shows the connection between predictive, hybrid and transform coding schemes. The resulting coding schemes are evaluated in terms of tangible system terms such as signal to noise ratio, mean square error and rate distortion curve. GRA

N80-18759# Stanford Univ., Calif. Systems Optimization Lab.
CONJUGATE-GRADIENT METHODS FOR LARGE-SCALE NONLINEAR OPTIMIZATION
Phillip E. Gill and Walter Murray Oct. 1979 65 p refs Presented at the 24th Intern. Meeting of the Inst. of Management Sci., Hawaii, Jun. 1979
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A078713; SU-SOL-79-15; ARO-16470.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we discuss several recent conjugate-gradient type methods for solving large-scale nonlinear optimization problems. We demonstrate how the performance of these methods can be significantly improved by careful implementation. A method based upon iterative preconditioning will be suggested which performs reasonably efficiently on a wide variety of significant test problems. Our results indicate that nonlinear conjugate-gradient methods behave in a similar way to conjugate-gradient methods for the solution of systems of linear equations. These methods work best on problems whose Hessian matrices have sets of clustered eigenvalues. On more general problems, however, even the best method may require a prohibitively large number of iterations. We present numerical evidence that indicates that the use of theoretical analysis to predict the performance of algorithms on general problems is not straightforward. GRA

N80-18760# Naval Research Lab., Washington, D. C.
GUIDE TO VECTORIZATION ON THE NAVAL RESEARCH LABORATORY'S TEXAS INSTRUMENTS ADVANCED SCIENTIFIC COMPUTER. VOLUME: VECTORIZATION PRIMER
Barbara Brooks, Harvey Brock, and Max Miller (Texas Univ. at Austin) 13 Nov. 1979 26 p refs
(AD-A077365; NRL-MR-4102-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Vectorization Primer is for programmers newly using the Texas Instruments Advanced Scientific Computer (ASC) and it is for managers, scientists, and programmers who are contemplating the ASC. The concept of vectorization is introduced and illuminated. Fundamental principles and basic programming techniques for achieving vectorization are presented. Problems and pitfalls that FORTRAN programmers, new to the ASC, encounter in writing and vectorizing FORTRAN programs are discussed. This information is useful to the potential ASC user for weighing the benefits of vectorization against the costs of vectorization in programming effort. This information assists the new ASC programmer in mastering concepts and techniques for vectorization. It guides him/her around irksome pitfalls. Volume 2 of the Guide to Vectorization on the Naval Research Laboratory's Texas Instruments Advanced Scientific Computer is for experienced ASC programmers. Advanced vectorization techniques, examples, and considerations are presented. GRA

N80-18761# Research Inst. of National Defence, Stockholm (Sweden).
GRAF: AN AUXILIARY PROGRAM FOR PRESENTATION OF FUNCTIONS IN 90 DEGREE COORDINATES WITH TEKTRONIX 4051 [GRAF - ETT HJAALPPROGRAM FOER PRESENTATION AV FUNKTIONER I RAATVINKLIGA KOORDINATER MED TEKTRONIX 4051]
Carl Reuterswaard Jun. 1979 36 p refs In SWEDISH
(FOA-C-54027-H2) Avail: NTIS HC A03/MF A01

An interactive computer program written in BASIC is described which creates a dialog with the user, requesting the input values needed for drawing curves and their labels. The general purpose program has been used for plotting meteorological data as well as physiological data. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

N80-18762 Ohio State Univ., Columbus.
DESIGN AND ANALYSIS OF THE DISTRIBUTED DOUBLE-LOOP COMPUTER NETWORK (DDLCN) Ph.D. Thesis
Jacob John Wolf, III 1979 243 p
Avail: Univ. Microfilms Order No. 8001859

A dynamically fault-tolerant computer network is presented that operates under totally distributed control. Detection and recovery schemes are presented for both link and interface faults. Analytical and simulation models are developed that predict message flow patterns and expected message transmission times. The simulation model is also used to investigate several dynamic message routing algorithms. Dissert. Abstr.

N80-18763 Princeton Univ., N. J.
THE DESIGN OF DEADLOCK- AND LIVELOCK-FREE PACKET SWITCHING NETWORKS Ph.D. Thesis
Sam Toueg 1979 88 p
Avail: Univ. Microfilms Order No. 8005282

Several types of deadlock free uniform local flow control procedures (controllers) that prevent store and forward deadlocks in any packet switching network are presented. These local controllers are executed independently by each node in a network, using only local information readily available to these nodes. Several properties of the proposed deadlock-free uniform controllers, as well as their relationship, are given, and a proof of their optimality with respect to deadlock-free uniform controllers using the same local information is presented. A deadlock- and livelock-free local controller is described which guarantees that every packet reaches its destination within a finite amount of time from the moment of its creation. Dissert. Abstr.

N80-18764 Ohio State Univ., Columbus.
INTERPROCESS COMMUNICATION AND SYNCHRONIZATION FOR DISTURBED SYSTEMS Ph.D. Thesis
Roberto Pardo 1979 242 p
Avail: Univ. Microfilms Order No. 8001800

Strategies for routing multi destination messages, mainly in local architectures are developed. The exchange of multi destination messages deals with the design of several protocols at various levels that ensure different degrees of reliability. The levels considered are: (1) unreliable level, where the protocol implements process addressing and chooses the best multi destination routing algorithm; (2) best effort to deliver level, where the protocol attempts to deliver the message to as many of its destinations as possible, filtering duplicates and out of order messages at each destination; and (3) guarantee to deliver level, where the protocol ensures that every destination will receive the message, regardless of momentary unavailability due to communication or processing system failures. Dissert. Abstr.

N80-18765 Illinois Univ. at Urbana-Champaign.
A COMPREHENSIVE APPROACH TO THE PERFORMANCE MEASUREMENT AND EVALUATION OF LARGE-SCALE COMPUTER SYSTEMS Ph.D. Thesis
Herbert Walker Merrill, Jr. 1979 66 p
Avail: Univ. Microfilms Order No. 8004226

The performance measurement and evaluation of large scale computer systems do not require hardware and software monitors as data collectors, but rather a comprehensive approach is described which uses only the computer system's accounting file as the data source. This data is processed into a performance data base which is the primary tool of this approach, and it is used to establish meaningful and measurable performance objectives. The objectives for service are related to resource consumption by a charging scheme that charges a higher price for better service, and thus capacity measures (for equipment acquisition or release) relate directly to qualitative and quantitative measures of user satisfaction versus supplier's costs. The implementation of the performance data base is described and the development of specific objectives for several systems (batch, interactive) is described. Examples of the capacity measures are shown, and several examples of the simplicity, cost-effectiveness and utility of the approach are described. Dissert. Abstr.

N80-18766 Oregon State Univ., Corvallis.
ANALYSIS OF NEW PROTOCOLS FOR COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Clifford John Warner 1980 287 p
Avail: Univ. Microfilms Order No. 8002630

An advanced forward area tactical radar network, now under conceptual development by the Air Force Electronic Systems Division, can be viewed as a novel form of computer network but with other unique problems resulting from the specialized nature of the application. The proposed network will link together a number o short-range radars, each with associated data processing equipment, so that each radar site has a complete file of tracks for all targets seen by any radar in the network. In addition, the communication network is expected to be used for transmission of a variety of other types of command and control messages. A new class of adaptive routing protocols for computer communication networks has been developed in this thesis, using the radar network as a basis, but applicable to any computer communication network. These new routing protocols utilize new techniques for searching out and using both reciprocal paths (paths over which messages can travel in either direction) and nonreciprocal paths (paths over which messages can travel in only one direction) for directed message routing. The computations required by the new routing protocols are carried out in a distributed manner at each network node. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-18767 Illinois Univ. at Urbana-Champaign.
CONTROLLABILITY AND ACCESSIBILITY IN NONLINEAR CONTROL SYSTEMS Ph.D. Thesis
Kevin Anthony Grasse 1979 186 p
Avail: Univ. Microfilms Order No. 8004177

The stability of certain properties of nonlinear control systems were investigated. It is shown that the fixed endtime accessibility property is generic (in a strong sense) and that, under certain conditions, fixed endtime controllability to a compact set is preserved under small perturbations. Results are phrased in terms of control vector fields on a differentiable manifold. Dissert. Abstr.

N80-18768*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
THE REDUCED ORDER MODEL PROBLEM IN DISTRIBUTED PARAMETER SYSTEMS ADAPTIVE IDENTIFICATION AND CONTROL Interim Report
C. Richard Johnson, Jr. Mar. 1980 76 p refs
(Grant NAG-I-7)
(NASA-CR-162807) Avail: NTIS HC A05/MF A01 CSCL 09B

The research concerning the reduced order model problem in distributed parameter systems is reported. The adaptive control strategy was chosen for investigation in the annular momentum control device. It is noted, that if there is no observation spill over, and no model errors, an indirect adaptive control strategy can be globally stable. Recent publications concerning adaptive control are included. F.O.S.

N80-18769*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ROBUSTNESS RESULTS IN LQG BASED MULTIVARIABLE CONTROL DESIGNS
Norman A. Lehtomaki, Nils R. Sandell, Jr. (Alpha Tech. Inc., Burlington, Mass.), and Michael Athans Feb. 1980 77 p refs
(Grant NGL-22-009-124; Contracts ET-78-C-01-3395; N00014-79-C-0377)
(LIDS-P-976; NASA-CR-162813) Avail: NTIS HC A05/MF A01 CSCL 09B

The robustness of control systems with respect to model uncertainty is considered using simple frequency domain criteria. Results are derived under a common framework in which the minimum singular value of the return difference transfer matrix is the key quantity. In particular, the LQ and LQG robustness results are discussed. K.L.

N80-18770# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A TRUTH MAINTENANCE SYSTEM
Jon Doyle Jun. 1979 47 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-04828)
(AD-A078419; AI-M-521) Avail: NTIS HC A03/MF A01 CSCL 05/8

To choose their actions, reasoning programs must be able to make assumptions and subsequently revise their beliefs when discoveries contradict these assumptions. The Truth Maintenance System (TMS) is a problem solver subsystem for performing these functions by recording and maintaining the reasons for program beliefs. Such recorded reasons are useful in constructing explanations for program actions and in guiding the course of action of a problem solver. This paper describes (1) the representations and structure of the TMS, (2) the mechanisms used to revise the current set of beliefs, (3) how dependency-directed backtracking changes the current set of assumptions, (4) techniques for summarizing explanations of beliefs, (5) how to organize problem solvers into 'dielectically arguing' modules, (6) how to revise models of the belief systems of others, and (7) methods for embedding control structures in patterns of assumptions. We stress the need of problem solvers to choose between alternate systems of beliefs, and outline a mechanism by which a problem solver can employ rules guiding choices of what to believe, what to want, and what to do. GRA

N80-18771# Maryland Univ., College Park. Computer Science Center.
CONNECTED COMPONENT LABELING USING QUADTREES
Hanan Samet Apr. 1979 30 p refs
(Contract DAAG53-76-C-0138; DARPA Order 3206)
(AD-A076130; CSC-TR-756) Avail: NTIS HC A03/MF A01 CSCL 05/8

An algorithm is presented for labeling the connected components of an image represented by a quadtree. The algorithm proceeds by exploring all possible adjacencies for each node once and only once. Once this is done, any equivalences generated by the adjacency labeling phase are propagated. Analysis of the algorithm reveals that its worst case average execution time is bounded by a quantity proportional to the product of the log of the region's diameter and the number of blocks comprising the area connected by the components. GRA

N80-18772# Maryland Univ., College Park. Computer Vision Lab.
SECOND-ORDER STATISTICS OF TEXTURE PRIMITIVES Interim Report
Shyuan Wang, Angela Wu, and Azriel Rosenfeld Jul. 1979 32 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A077390; TR-779; AFOSR-79-1162TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

Primitive 'elements' were extracted from a set of textures; a set of attributes was measured for each primitive; and second-order statistics of these attributes were computed for pairs of neighboring primitives, using several definitions of 'neighboring'. In some cases, textures not discriminable used statistics of the second order. GRA

N80-18773# Stanford Univ., Calif. Dept. of Computer Science.
USING PATTERNS AND PLANS TO SOLVE PROBLEMS AND CONTROL SEARCH
David Edward Wilkins Jul. 1979 267 p refs Sponsored in part by National Science Foundation
(Contract MDA903-76-C-0206; NSF MCS-78-00524)
(AD-A076872; SU-STAN-CS-79-474; AIM-329) Avail: NTIS HC A12/MF A01 CSCL 06/4

The type of reasoning done by human chess masters has not been done by computer programs. The purpose of this research is to investigate the extent to which knowledge can replace and support search in selecting a chess move and to delineate the issues involved. This has been carried out by constructing a program, PARADISE (Pattern Recognition Applied to Directing Search), which finds the best move in tactically sharp middle game positions from the games of chess masters. GRA

N80-18774# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 1. Final Report, Sep. 1976 - Nov. 1979
Nov. 1979 393 p
(Contract DCA100-76-C-0083)
(AD-A078391; AD-E100313; Rept-66157) Avail: NTIS HC A17/MF A01 CSCL 09/2

The Distributed Master Control Program (DMCP) and the technical control application programs of the Modular System Control Development Model (MSCDM) are described. Program listings of each program and subprogram are presented. Programs are written in FORTRAN and MACRO-11 for Digital Equipment Corporation (DEC) LSI-11 microcomputers. GRA

N80-18775# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 2 Final Report, Sep. 1976 - Nov. 1979
Nov. 1979 296 p
(Contract DCA100-76-C-0083)
(AD-A078392; AD-E100314; Rept-66158) Avail: NTIS HC A13/MF A01 CSCL 09/2

Program descriptions and listings of the Modular System Control Development Model utility programs and diagnostics are presented. This includes the Bootstrap Load Facility for the Ring Architecture. GRA

N80-18776# Burroughs Corp., Paoli, Pa. Federal and Special Systems Group.
SOFTWARE MAINTENANCE MANUAL FOR THE MODULAR SYSTEM CONTROL DEVELOPMENT MODEL (MSCDM), BOOK 3 Final Report, Sep. 1976 - Nov. 1979
Nov. 1979 89 p
(Contract DCA100-76-C-0083)
(AD-A078393; AD-E100315; Rept-66159) Avail: NTIS HC A05/MF A01 CSCL 09/2

Program flow charts are presented. Flow charts for all operating systems, applications, diagnostic and utility programs are included in this single volume. GRA

N80-18777# Colorado Univ. at Boulder. Dept. of Electrical Engineering.
FEEDBACK SYSTEM DESIGN Annual Report
Isaac M. Horowitz 1979 24 p refs
(Grant AF-AFOSR-2946-76; AF Proj. 2304)
(AD-A078486; AFOSR-79-1238TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In Quantitative Feedback Synthesis, bounds on plant uncertainty and on the system performance are specified a priori. The minimum feedback is used which satisfies the latter over the range of plant uncertainty. The principal effort during the past year was in extending Quantitative Feedback Synthesis to two new highly complex, multiple-loop, single input-output plant structural classes. The significant advantage of multiple-loop over single-loop is that, in highly uncertain systems, the same performance specifications can be satisfied, with tremendously smaller sensor noise effects. A technique denoted as 'Design Perspective' was developed, which enables the designer to evaluate the trade-offs without a detailed design. Thus, early in the game and before doing a detailed design, the designer can obtain an excellent idea of which loops (sensors) to use and which to omit and the portion of the 'feedback burden' to assign to each loop. The same design techniques are applicable to highly uncertain nonlinear plants with the same structure. Several complex detailed design examples with very large uncertainty were done. Design perspective results were very close to the final design results. The designs were simulated on the digital computer and in all cases satisfied the a priori assigned performance specifications. GRA

N80-18778# Brown Univ., Providence, R. I. Center for Dynamical Systems.
OPTIMAL DISCOUNTED LINEAR CONTROL OF THE WIENER PROCESS Interim Report
Icannis Karatzas Sep. 1979 18 p refs
(Grant AF-AFOSR-3063-77; AF Proj. 2304)
(AD-A078487; AFOSR-79-1249TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

We consider the problem of discounted optimal control of the Wiener process, transformed by the action of a nonanticipative control into the state process. The latter satisfies the state equation on an appropriate probability space. There is a cost per unit time for being in the wrong state which is an even, uniformly convex function on the reals whose second derivative is decreasing with distance from the origin. There is also a cost per unit time for using the control. Both costs are discounted in time by a factor and the control action is limited. The controller has to choose a law as a nonanticipative, measurable functional of the state process with values so as to minimize the expected discounted total cost. In the present paper we proceed by formulating the control problem. The Bellman equation of dynamic programming is explicity solved and the candidate for the optimal law is discerned from the properties of the solutions. Optimality of the candidate is proved. GRA

N80-18779# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.
SOME PROPERTIES OF THE DUAL ADAPTIVE STOCHASTIC CONTROL ALGORITHM Interim Report
Pierre Dersin, Michael Athans, and David A. Kendrick Aug. 1979 31 p refs
(Grant AF-AFOSR-3321-77; AF Proj. 2304)
(AD-A078488; LIDS-P-936; AFOSR-79-1254TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The purpose of this paper is to compare analytically the properties of the suboptimal dual adaptive stochastic control algorithm when the plant dynamics contain multiplicative white noise parameters. A simple scalar example is used for this analysis. GRA

N80-18780# Brown Univ., Providence, R. I. Center for Dynamical Systems.
CONTROL OF DYNAMICAL SYSTEMS Interim Report, 1 Sep. 1978 - 30 Aug. 1979
J. K. Hale, H. T. Banks, E. F. Infante, and J. P. LaSalle Oct. 1979 33 p refs
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A078489; AFOSR-79-1251TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Fifteen papers were prepared for publication or published during the ensuing period of research. Topics included identification and control of systems with delays, qualitative theory of functional differential and difference equations, nonlinear oscillations, control of dynamical systems, and stability of infinite-dimensional systems. GRA

N80-18781# California Univ., Los Angeles. Dept. of System Science.
COUNTABLE STATE AVERAGE COST REGENERATIVE STOPPING PROBLEMS
Bruce L. Miller Apr. 1979 33 p refs
(Contract N00014-76-A-0004; Grant NSF ENG-76-12250)
(AD-A078509; UCLA-WP-288) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Regenerative stopping problems are stopping problems which recommence from the initial state upon stopping. An algorithm is presented which solves a semi-Markov regenerative stopping problem with a finite number of continue actions by solving a sequence of stopping problems. New results for the optimal stopping problem are obtained as well as for the regenerative stopping problem. Two models in the literature are used as detailed examples of the algorithm. GRA

N80-18782# California Univ., Los Angeles. Dept. of System Science.
OPTIMAL INVESTIGATION AS A REGENERATIVE STOPPING PROBLEM
A. Gregory Buckman and Bruce L. Miller May 1979 27 p refs
(Contract N00014-78-C-0428; Grant NSF ENG-76-12250)
(AD-A078510; UCLA-WP-289) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This report discusses the problem of dynamic optimal investigation of a two-state (in control, out of control) system. The true state can only be inferred from reported costs and the time since the last correction. It is demonstrated that when the parameters satisfy certain conditions, such problems can be efficiently solved as regenerative stopping problems. Some general results for regenerative stopping problems are also obtained. In the last section the problem is generalized to n two-state systems. By combining simulation with the Regenerative Stopping Algorithm, a problem with 20 state variables is solved with a small error term. GRA

N80-18783# University of Southern California, Los Angeles. Dept. of Aerospace Engineering.
NEW METHODS FOR ANALYSIS OF THE PERFORMANCE OF GUIDANCE AND CONTROL SYSTEMS Annual Interim Report, 1 Oct. 1978 - 30 Sep. 1979
Richard S. Bucy Sep. 1979 3 p refs
(Grant AF-AFOSR-3100-76; AF Proj. 2304)
(AD-A078534; AFOSR-79-1152TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The investigation has continued in the use of information theory and in particular rate distortion theory to derive useable upper and lower bounds on the expected loss for the nonlinear filtering problem. A new design criterion has been derived which leads to effective designs of large systems when the entire state is not available for feedback control. Preliminary results have been obtained on the problem of absolute phase demodulation. New results which evaluate the information loss which results from use of the classical phase lock loop instead of the optimal demodulator, have been obtained and are being investigated. Author (GRA)

N80-18784# Cornell Univ., Ithaca, N. Y. School of Operations Research and Industrial Engineering.
INCOMPLETE BLOCK DESIGNS FOR COMPARING TREATMENTS WITH A CONTROL. 3: OPTIMAL DESIGN FOR $p = 4, k = 3$ AND $p = 5, k = 3$
Robert E. Bechhofer and Ajit C. Tamhane (Northwestern Univ.) Oct. 1979 27 p refs
(Contracts DAAG29-77-C-0003; N00014-75-C-0586; Grant NSF ENG-77-06112)
(AD-A078331; TR-436) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper continues the study of balanced treatment incomplete block (BTIB) designs. The definitions of inadmissibility and strong inadmissibility are generalized. The search for optimal designs is restricted to the smaller class of admissible designs obtained using these new definitions. Lists of generator designs, the (conjectured) complete class of generator designs, catalogs of admissible designs, and tables of optimal designs are given for $p = 4, k = 3$ and $p = 5, k = 3$. GRA

N80-18786# Northwestern Univ., Evanston, Ill. Dept. of Mechanical Engineering.

OPTIMAL CONTROL OF SYSTEMS WITH UNCERTAINTY Interim Report, Sep. 1978 - Aug. 1979

W. E. Schmitendorf 1979 91 p refs
(Grant AF-AFOSR-2423-76; AF Proj. 2304)
(AD-A078433; AFOSR-79-1257TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The first problem considered was that of steering a system without disturbances to the origin when the magnitude of the control is constrained. A technique was developed for determining if a system can be steered to the origin and also a method for obtaining such a control when it exists. Next, the controllability problem was generalized by allowing for targets other than the origin. To reduce computational capability, a method was developed which exploits the affine nature of the target and requires the solution of a smaller dimensional optimization problem. One other area which has been under investigation is that of avoidance control. The controllability problem for systems with disturbances is being investigated. Research is also continuing on controllability of systems without disturbances. Work is also in progress on the avoidance control problem as well as the closely related holding problem. GRA

N80-18786# Cornell Univ., Ithaca, N. Y.

INCOMPLETE BLOCK DESIGNS FOR COMPARING TREATMENTS WITH A CONTROL. 1: GENERAL THEORY

Robert E. Bechhofer and Ajit C. Tamhane Mar. 1979 36 p refs
(Contracts DAAG29-77-C-0003; N00014-75-C-0586; Grant NSF ENG-77-06112)
(AD-A078330; TR-414) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is the first paper of a series in which we outline a theory of optimal incomplete block designs for comparing several treatments with a control, and give plans of optimal designs to use for this purpose. In the present paper we develop the basic theory of the incomplete block designs which are appropriate for the many-to-one comparisons problem; the optimality considerations for such designs will be addressed in subsequent papers. For this problem we propose a new general class of incomplete block designs which are balanced with respect to test treatments. We shall use the abbreviation BTIB to refer to such designs. We study their structure, and give some methods of construction. A procedure for making exact joint confidence statements for our multiple comparisons problem is described. Using a new concept of admissibility of designs, it is shown how 'inferior' designs can be eliminated from consideration. Some open problems concerning construction of BTIB designs are posed. GRA

N80-18787# Massachusetts Inst. of Tech., Cambridge. Lab. of Information and Decision Systems.

A FUNCTIONAL EXPANSION APPROACH TO THE SOLUTION OF NONLINEAR FEEDBACK PROBLEMS Interim Report

Ram-Nandan P. Singh (Mitre Corp., McLean, Va.) and Timothy L. Johnson Aug. 1979 24 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A077408; LIDS-P-796-A; AFOSR-79-1189TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The application of a functional expansion technique introduced by Bellman to the determination of nonlinear optimal control laws is described. For a certain class of 'smooth' control problems, it is demonstrated that convergence of the expansion technique may be improved by use of a nonlinear (rather than linear) auxiliary equation which is based on a known cost-to-go function for an associated 'linear-quadratic' optimal control problem. GRA

N80-18788# Brown Univ., Providence, R. I. Div. of Applied Mathematics.

PARTIALLY OBSERVED STOCHASTIC CONTROL SYSTEMS

Wendell H. Fleming and Etienne Pardoux 1979 4 p refs
(Grants AF-AFOSR-3063-77; NSF MCS-76-07261; AF Proj. 2304)
(AD-A078290; AFOSR-79-1166TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, the authors are concerned with the existence of optimal controls for problems. The method depends on introducing another stochastic control problem which is called a 'separated' problem. For several years the question of proving a general theorem about existence of optimal controls in the strict sense has been open. The authors do not obtain such a result here. However, they obtain an existence theorem in which a somewhat wider class of control processes is admitted. GRA

N80-18789# Brown Univ., Providence, R. I. Center for Dynamical Systems.

NUMERICAL METHODS AND APPROXIMATION AND MODELLING PROBLEMS IN STOCHASTIC CONTROL THEORY Final Report, 1 Jul. 1978 - 30 Jun. 1979

Wendell H. Fleming and Harold J. Kushner 15 Aug. 1979 8 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A078288; AFOSR-79-0972TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Many areas of stochastic control were studied in this period. Monte Carlo algorithms of type appearing in adaptive systems were studied and stability, convergence and rate of convergence results obtained. The analytical techniques developed for this purpose have a wide applicability in the study of similar algorithms. Robust computationally oriented approximations to optimal non-linear filters were developed. A deep study of how to find the Markov system that best approximates a given non-linear system with a wide band-width input was undertaken and very good results obtained. The problem is important in control and communication theory because it is usually desired to use the many available methods for analyzing Markov systems. The results obtained seem to be the best available so far and application to control and communication theory are being pursued. Optimal stochastic control problems under the condition of partial information on the system state were studied and a new formulation, similar to that of the non-linear filtering problem, developed. The approach seems promising in providing qualitative information on this difficult class of problems. Part of the technique uses measure-valued processes in a way which has wider applicability to problems involving distributed states or information. GRA

N80-18790# Control Dynamics Co., Huntsville, Ala.

APPLICATION OF DIGITAL TECHNOLOGY TO GUIDANCE AND CONTROL THEORY Technical Report, 1 Aug. - 30 Sep. 1979

S. M. Seltzer 30 Sep. 1979 21 p refs
(Contract DAAK40-79-C-0213)
(AD-A078815; CDC-79-3) Avail: NTIS HC A02/MF A01 CSCL 12/1

The purpose of the study reported upon herein is to investigate the potential existence of a clustering of system poles and zeros in the z-domain. This potential is shown to exist. A means of separating the clustering is proposed by mapping from the complex z-domain onto the complex w-domain. The reason for so-doing is to ameliorate computational difficulties that can arise as the result of closely clustered roots. GRA

N80-18791# Technical Research Centre of Finland, Espoo. Electrical Engineering Lab.

OPTIMAL CONTROL PROBLEMS WITH DISCRETE TIME, LINEAR DYNAMICS, AND CONVEX STATE-CONTROL CONSTRAINTS Ph.D. Thesis - Helsinki Univ.

Eero Tamminen 1979 49 p refs Sponsored by Emil Aaltonen Foundation
(VTT-ENT-26; ISBN-951-38-0797-5) Avail: NTIS HC A03/MF A01

The assumptions about the structure and the elements of optimal control problems are defined. The original problem is converted into an equivalent Lagrangian optimization problem. The functional analytic approach of Dubovitskij and Milyutin is applied to the Lagrangian problem and necessary conditions for optimality are derived for the original problem in the form of a maximum principle. In the time-point-wise Hamiltonian minimization problems, which give the optimal control, explicit state-control constraints are presented. The driving Lagrange multiplier vector in the adjoint state equations is characterized as the solution to the optimization problem which is the dual of the Hamiltonian problem. Owing to the convexity assumptions, the maximum principle is also a sufficient condition for optimality. The possibility of avoiding singular solutions by reformulating state constraints into state-dependent control constraints is treated. The maximum principle leads to a two-point boundary value problem. An iterative scheme for solving this problem is considered. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-18792 University of Southern Illinois at Carbondale.
STABILITY CONSIDERATIONS FOR VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS Ph.D. Thesis
Leigh Carl Becker 1979 82 p
Avail: Univ. Microfilms Order No. 8004027

The basic stability properties of the equation x prime (t) = A(t)x(t) + the integral from 0 to t of C(t,u)x(u)du + f(t) are considered, where A and C are continuous n by n matrices, f is a continuous n-vector-valued function, and x is an n-vector. A solution is expressed in terms of the solutions of an associated family of homogeneous equations via a variation of parameters formula. Stability results for the associated family when A(t) is identically equal to A, a constant stable matrix, are obtained in terms of a symmetric positive definite matrix. When f(t) is identically equal to 0, necessary and sufficient conditions are obtained for uniform stability, uniform asymptotic stability, and exponential asymptotic stability. These results coupled with the variation of parameters formula yield some perturbation results. Dissert. Abstr.

N80-18793 Massachusetts Univ., Amherst.
COMPLEMENTATION, REGULARITY AND CONVERGENCE OF MEASURES IN BANACH SPACES GENERATED BY QUANTUM LOGICS Ph.D. Thesis
Olga Rozinak Beaver 1979 71 p
Avail: Univ. Microfilms Order No. 8004896

Assuming that a quantum logic, 2, carries a sufficiently large collection of states, the collection is embedded as base for a base-norm space S. Then 2 can be embedded in the order-unit Banach dual S^* of S and the base-norm Banach dual S^{**} of S^* consists of functions which, restricted to 2, are finitely additive. It is shown that if the collection of states is regular with respect to a particular subset P of 2, then each function in S^{**} can be decomposed into countably additive and purely finitely additive parts. It is further shown that weak compactness of sets of functions in S can be determined by the behavior of the functions either on certain maximal lattice subsets of S^*, or on P if the collection of states is P-regular. Finally, criteria are established under which a closed subspace of S^* is not topologically complemented in S^*. Dissert. Abstr.

N80-18794 Alabama Univ., University.
STABILITY THEORY FOR MATHEMATICAL PROGRAMMING PROBLEMS WITH UNBOUNDED CONVEX FEASIBLE REGIONS: A POINT-TO-SET SUBMAP APPROACH Ph.D. Thesis
Robert Grover Batson 1979 39 p
Avail: Univ. Microfilms Order No. 8004529

The stability is examined of mathematical programming problems when the resource vector associated with the constraints is perturbed. Using classical decomposition theorems. A line-free unbounded closed convex feasible region is written as the sum of the convex hull of its extreme points plus its recession cone. The regularity assumption is that the recession cones of the feasible regions are constant on a neighborhood of the original resource vector b. When the resource vector is varied, the convex hull of extreme points (the basic hull) becomes a submap of the feasible region point-to-set map. It is assumed that the basic hull is compact at b and base our analysis on semicontinuity properties of the basic hull at b. The optimal value is a function of the resource vector used to pose the problem. Stability is defined as the continuity of this optimal value function at b. Such continuity is significant for duality theory and in the practice of operations research. Sufficient conditions for continuity, and also for linear continuity of v at b are the major findings. Dissert. Abstr.

N80-18795 Wisconsin Univ. - Madison.
COALESCING BROWNIAN MOTIONS ON THE LINE Ph.D. Thesis
Richard Alejandro Arratia 1979 134 p
Avail: Univ. Microfilms Order No. 8001124

Coalescing Brownian motions on the real line R are defined and analyzed. This system is the continuous space analog of coalescing random walks on the lattice of integers Z. The system is constructed with arbitrary initial sets of particles. The system has an invariant equilibrium measure, a point process on R called pi sup c. A duality relation for the system of coalescing Brownian motions makes it possible to express the zero function of pi sup c in terms of finite systems of annihilating Brownian motions. Using coalescing Brownian motions, the limiting behavior of some nearest neighbor interaction particle systems on the one dimensional lattice Z, such as coalescing random walks, annihilating random walks, and the basic voter model can be analyzed. Dissert. Abstr.

N80-18796 Brandeis Univ., Waltham, Mass.
PROJECTIVE NORMALIZATION OF SURFACES WITH A FIXED HILBERT POLYNOMIAL Ph.D. Thesis
Carola AndujoRolon 1979 32 p
Avail: Univ. Microfilms Order No. 8002414

Let P(x) be a rational polynomial such that P(m) is an integer for every integer m. Let V be a projective surface defined over an algebraically closed field k and C sub V a generic hyperplane section over k. Let Sigma be the set of pairs (V, Cv) with a fixed Hilbert polynomial P(m) = chi(V, L(mC sub V). The aim is to prove that there is a constant M sub 0 depending only on the Hilbert polynomial chi(V, L(mC sub V)) such that for m greater than M sub O the linear system (mC sub V) defines a birational morphism 1/gamma for which gamma(V) is projectively normal. Associate to every pair (V, Cv) a pair (V^*, C^*), where f:V^* - V is the desingularization of V and C^* is the pull back f-1(Cv). By Bertini's theorem it is concluded that C^* is an absolutely irreducible curve. $(C^*)(2)$ $(C^*)(2)$ = (C sub V)(2) greater than O and I(C^*, Y) equal to or greater than O for every positive divisor Y on V^*. The idea is to use some results which are known for non-singular surfaces to prove the existence of an integer M sub O, independent of the choice of V, that is, depending only on the Hilbert polynomial such that the minimal sum of the linear systems A(C^*) and A(mC^*) is complete for M equal to or greater than M. Dissert. Abstr.

N80-18797 Montana Univ., Missoula.
THE CLASS NUMBER OF AN ALGEBRAIC NUMBER FIELD: ITS INTERPRETATION AND USE Ph.D. Thesis
Herbert Emil Kasube 1979 96 p
Avail: Univ. Microfilms Order No. 8002330

The history of algebraic number theory is examined. The definitions of ideal numbers and ideals for the algebraic number field K are reviewed. Kummer's theory of ideal numbers for K is used to develop an interpretation of the class number of K and to explain how small class numbers suggest that the integers of the field are close to being uniquely factorable. Background material is presented to interpret the vocabulary needed for the interpretation. The class number is shown to be useful in studying Fermat's last theorem. The application of the computer in studying the class number and connected topics such as Fermat's last theorem is discussed. Dissert. Abstr.

N80-18798 Duke Univ., Durham, N. C.
A HEYTING ALGEBRA BESTIARY, TERTIUM DAMUS Ph.D. Thesis
Samuel Bishop Johnson 1979 176 p

Avail: Univ. Microfilms Order No. 8003627

The concept of a Heyting algebra which is a generalization of the concept of a Boolean algebra is discussed. The definitions and facts of Heyting algebra are reviewed. Results concerning the structure of Heyting algebras, their varieties, and their relation to topoi are established. Four major results are established: (1) the free Heyting algebra on one generator is analyzed; (2) it is shown that the lattice of varieties of Heyting algebras contains a sublattice isomorphic to the lattice of all subsets of the natural numbers; (3) through construction of the appropriate topos it is shown that each Boolean algebra appears as the subobjects of the terminator in some value based topos; (4) the free Heyting algebra on two generators is shown to appear as the subobjects of the terminator in no value based topos. Dissert. Abstr.

N80-18799 Florida Univ., Gainesville.

ON DISCRETE METRICS AND BETWEENNESS RELATIONS Ph.D. Thesis

Edward Richard Howorka 1979 147 p

Avail: Univ. Microfilms Order No. 8002866

Classes of graphs G defined by conditions imposed on the metric or betweenness space associated with G are reported. It is shown that the class of integer valued metric spaces realizable in Husimi trees is characterized by a classical condition used often to describe the tree realizable metric spaces, the so called four point condition. Several other metric conditions satisfied by trees are considered, and the corresponding classes of graphs characterized. Distance hereditary graphs (graphs G whose connected induced subgraphs preserve the distance of G) are described in terms of their cycle and clique structure. Ptolemaic graphs (graphs whose associated metric space is ptolemaic) are shown to be distance hereditary. Several characterizations of ptolemaic graphs are given, and an operation is exhibited which generates finite ptolemaic graphs from complete graphs. Dissert. Abstr.

N80-18800 Houston Univ., Tex.

MANIFOLDS WITH GENERALIZED BOUNDARY AND DIFFERENTIAL SEMIGROUPS Ph.D. Thesis

George Erwin Graham 1979 79 p

Avail: Univ. Microfilms Order No. 8005125

The notion of a Frechet derivative is strengthened to apply to vector valued functions on subsets of Euclidean space with dense interior, and the possibility of extending differentiable functions is examined for certain special cases. The chain rule, inverse function theorem, and several other theorems from advanced calculus are established. The differential geometry is developed with emphasis on differentiable structures, the tangent bundle, products, vector fields, and the Lie bracket operation on vector fields. Differentiable semigroups are discussed. A differentiable semigroup is a semigroup S on an n-manifold with generalized boundary such that the multiplication function is differentiable. It is shown that if S has an identity, then the multiplication satisfies a cancellation law in a neighborhood of the identity. Dissert. Abstr.

N80-18801 Georgetown Univ., Washington, D.C.

K-UNIFORMLY CONVEX BANACH SPACES Ph.D. Thesis

Raymond Sylvester Geremia, Jr. 1979 116 p

Avail: Univ. Microfilms Order No. 8004693

Geometric properties of a Banach space which generalize uniform convexity was studied. These properties make use of notions of volume and area in a Banach space and it is shown that these notions are consistent with one's intuitions about volume and area. Results are shown for Banach spaces that are 2-uniformly convex or locally 2-uniformly convex. For spaces that are locally 2-uniformly convex it is shown that the concepts of norm and weak sequential convergence on the unit sphere are equivalent. It is also shown that the metric projection onto a closed and convex Chebyshev set is continuous in these spaces. Dissert. Abstr.

N80-18802 Arizona Univ., Tucson.

MULTIPHASE AVERAGING OF PERIODIC SOLITON EQUATIONS Ph.D. Thesis

Mark Gregory Forest 1979 293 p

Avail: Univ. Microfilms Order No. 8003057

The multiphase averaging of periodic soliton equations is considered. The periodic sine-Gordon equation and its associated inverse spectral theory are analyzed, including a discussion of the spectral representations of exact, N-phase sine-Gordon solutions. The physical characteristics of the periodic waves are emphasized with a motivation from the well-known whole-line solutions. A canonical Hamiltonian approach for the modulational theory of N-phase waves is prescribed. A concrete illustration of this averaging method is provided with the periodic sine-Gordon equation. For the KdV equation, very general results are given for multiphase averaging of the N-phase waves. Single-phase results are extended to general N phases, and more importantly, an invariant representation in terms of Abelian differentials on a Riemann surface is provided. Several consequences of this invariant representation are deduced, including strong evidence for the Hamiltonian structure of N-phase modulational equations. Dissert. Abstr.

N80-18803 Illinois Univ. at Urbana-Champaign.

SOME OPTIMAL AND NEAR-OPTIMAL LOW RATE ALGEBRAIC CONVOLUTION CODES Ph.D. Thesis

Robert Charles Esker 1979 107 p

Avail: Univ. Microfilms Order No. 8004161

The algebraic structure of certain classes of convolutional codes and several classes of optimal or near optimal convolutional codes are presented. Classes of Abelian codes which are ideals in a group algebra are discussed. It is shown that these Abelian codes and their weight distribution play a fundamental role in the construction and analysis of convolutional codes. Dissert. Abstr.

N80-18804 Florida Univ., Gainesville.

CONVERGENCE THEOREMS FOR ABSTRACT ASYMPTOTIC MARTINGALES Ph.D. Thesis

Robert Wayne Smith 1979 88 p

Avail: Univ. Microfilms Order No. 8002899

Convergence theorems are derived for asymptotic martingales which take values in a locally convex topological vector space and for scalar valued asymptotic martingales which are integrable with respect to a measure which takes values in such a space. Basic concepts and terminology concerning asymptotic martingales of real valued random variables are established. Several convergence theorems are developed for weakly measurable Pettis integrable asymptotic martingales which take values in a locally convex topological vector space. Conditions which insure a discrete parametered asymptotic martingale converges are obtained almost everywhere in the weak topology as well as Conditions guaranteeing weak convergence in measure of a continuous parametered asymptotic martingale. Dissert. Abstr.

N80-18805 Oklahoma State Univ., Stillwater.

DIVISIBILITY IN 3-MANIFOLD GROUPS Ph.D. Thesis

Stephen Andrew Sedory 1979 69 p

Avail: Univ. Microfilms Order No. 8003600

The scope of study for this research is concerned with answering the following group theoretic question. Given a positive integer n and an element g in a group G, does there exist in G a solution to the equation Xn = g? The question is restricted to those groups which occur as the fundamental group of certain 3-manifolds. It is translated to a topological setting and there becomes the question of whether a given loop in a given manifold is freely homotopic to a power of some other loop. The geometric properties of the class of manifolds considered are exploited to answer this question. The findings and conclusions are that an algorithm is constructed which answers the above question for those groups occurring as the fundamental group of compact, orientable, irreducible, sufficiently large 3-manifolds which contain no essential annuli or tori in their entire hierarchy. The algorithm provides, for a given manifold M and loop l in M, a list of all those positive integers n for which l is freely homotopic to the nth power of some loop sigma sub n. Further, for each such n, the algorithm constructs such a loop sigma sub n.Dissert. Abstr.

N80-18806 Pittsburgh Univ., Pa.

MAXIMUM LIKELIHOOD ESTIMATION IN AUTOREGRESSIVE PROCESSES WITH MISSING OBSERVATION Ph.D. Thesis

Suan-Boon Tan 1979 90 p

Avail: Univ. Microfilms Order No. 8004879

Three methods are proposed for estimation in autoregressive processes when there are missing observations. These methods use a maximum likelihood approach and are based on the EM algorithm, the Newton-Raphson method, and the method of scoring applied to the likelihood equations. The resulting estimation equations are modified by excluding certain asymptotically negligible terms. Under suitable conditions on missing patterns estimates obtained from the Newton-Raphson method and the method of scoring are consistent, asymptotically normal and one-step asymptotically efficient if the initial estimates are consistent. Additionally, estimation in autoregressive moving average processes with missing observations is considered. Finally, extension to vector autoregressive moving average processes with missing observations is also discussed. Dissert. Abstr.

N80-18807 Rensselaer Polytechnic Inst., Troy, N. Y.
A MATHEMATICAL MODEL OF SPATIALLY LOCALIZED NEURAL SYSTEMS Ph.D. Thesis
James Richard Brannan 1979 122 p
Avail: Univ. Microfilms Order No. 8004755

A probabilistic model of a spatially localized, mutually excitatory (inhibitory) population of neurons is formulated. The state variable of a typical neuron within a densely interconnected population of neurons is assumed to be a stochastic process, X(t), representing the difference in electromagnetic potential across the cell membrane at the soma. The stochastic differential equation formulated for X(t) is that of a jump process, but physiological considerations suggest that a diffusion approximation is viable. Sufficient conditions for a diffusion model are derived. The Fokker-Planck diffusion equation is then modified to allow for: (1) a refractory period following absorption of the process at a boundary; and (2) excitatory (inhibitory) feedback from within the population. The resulting nonlinear hybrid system of equations provides a concise description of the activity of the neural populations under consideration. Dissert. Abstr.

N80-18808 Oklahoma State Univ., Stillwater.
THE DEVELOPMENT OF NORMAL FUNCTIONS Ph.D. Thesis
Joan E. Palsmeier Bell 1979 105 p
Avail: Univ. Microfilms Order No. 8003557

The development of normal functions from their origin to the present is discussed. Normal functions are defined in terms of normal families, which had their beginning in 1912. The term normal function first appeared in print in 1957 in an paper by Lehto and Virtanen in which they extended the Lindelof property from analytic and bounded to meromorphic functions. Many results on normal functions have since appeared in the mathematical journals. The analyzation of these theorems resulted in the grouping of the theorems into five major categories, which are presently abbreviated as those related to uniform rho-d continuity, generalizations of several of Lehto and Virtanen's results, cluster sets, the spherical derivative, and miscellaneous results. Among the areas for future study are normal harmonic functions and variations of normality. The study shows that since the paper by Lehto and Virtanen, normal functions have become an important area in the field of complex variables. Dissert. Abstr.

N80-18809# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPROXIMATION BY POLYNOMIAL ARCS TO GENERATE SUBOPTICAL NUMERICAL SOLUTIONS IN CONTROL PROBLEMS
Atair Rios Neto Dec. 1979 11 p refs Presented at 5th COBEM Conf., Campinas, Spain, 12 Dec. 1979 Revised
(INPE-1642-RPE/098-Rev) Avail: NTIS HC A02/MF A01

A direct search procedure is proposed for generating suboptimal numerical solutions for dynamical systems optimal control problems. An approximation by polynomial arcs for the control function is taken and a first order gradient type of numerical search is adopted, reducing the problem in each iteration, to one of parameter optimization. R.C.T.

N80-18810# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE BOLTZMANN AND THE FOKKER-PLANCK EQUATIONS
J. A. Bittencourt Oct. 1979 60 p
(INPE-1606-RPE/082-Rev) Avail: NTIS HC A04/MF A01

A derivations are presented of the Boltzmann collision integral, which applies to the case of binary collisions in a dilute gas, and of the Fokker-Planck collision term, which applies to the case of multiple Coulomb interactions in a plasma. The assumptions involved in the derivation of the Boltzmann collision integral, and its irreversible character, are discussed. An anlaysis of Boltzmann's H theorem and a derivation of the equilibrium Maxwell-Boltzmann distribution function, based on a maximum entropy approach, are also presented. An aproximate expression for the Boltzmann collision term, valid for a weakly ionized plasma, is obtained through a spherical harmonic expansion of the distribution function. Next the Fokker-Planck equation is derived, starting from the Boltzmann collision integral. Finally, the Fokker-Planck coefficients are calculated for the Coulomb interaction and applied to the case of electron-ion collisions. Author

N80-18811*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL INSTABILITY AND STABILIZATION OF THE KINEMATIC DIFFERENTIAL EQUATION USING QUATERNIONS
W. Geiger Nov. 1979 9 p refs Transl. into ENGLISH from Z. Angew. Math. Mech. (West Germany), v. 59, no. 5, May 1979 p T 118 - T 120 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75731) Avail: NTIS HC A02/MF A01 CSCL 12A

The possibility of using quaternions to describe the position of a gyroscope with a given rotating vector is discussed. K.L.

N80-18812# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
A PROJECTED STOCHASTIC APPROXIMATION METHOD FOR ADAPTIVE FILTERS AND IDENTIFIERS Interim Report
Harold J. Kushner 22 Aug. 1979 15 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A078602; AFOSR-79-1250TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report deals with a great variety of stochastic approximation procedures, for constrained and unconstrained systems and for convergence w.p.1. and weak convergence, all for systems with correlated inputs. The techniques are readily usable for many problems that are not explicitly treated there. This will be illustrated here for one particular class of constrained problems which is of great current interest and which arises in identification and in adaptive control theory. In fact, it is just such constrained problems to which more attention should be given, owing to their prevalence. The proofs are contained in various parts and, after the problem is defined, it is shown how to put the bits and pieces together. The problem and method are typical of a large class of adaptive systems which can be treated by similar methods, and is worth singling out. GRA

N80-18813# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
REMARKS ON BIFURCATION THEORY IN DIFFERENTIAL EQUATIONS Interim Report
Jack K. Hale 1979 13 p refs
(Grants AF-AFOSR-3092-76; DAAG27-76-G-0294; NSF MCS-79-05774)
(AD-A078689; AFOSR-79-1247TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper discusses primarily the idea of genericity in bifurcation theory for one and two parameter problems. Recent results on homoclinic points are mentioned as well as a connection between the bifurcation function and dynamic behavior. GRA

N80-18814# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
STABILITY FROM THE BIFURCATION FUNCTION Interim Report
Jack K. Hale 11 Oct. 1979 13 p refs
(Grants AF-AFOSR-3092-76; DAAG27-76-G-0294; NSF

MCS-79-05774; AF Proj. 2304)
(AD-A078688; AFOSR-79-1248TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

This paper contains an extension to C superscript k -vector fields of the classical results of Liapunov on the stability of an equilibrium point in the critical case of one zero root. The transformation theory of Liapunov is not applicable to this case. We exploit fundamental relations from bifurcation theory. GRA

N80-18815# California Univ., Berkeley. Electronic Research Lab.

NO PERIOD TWO IMPLIES CONVERGENCE, OR WHY USE TANGENTS WHEN SECANTS WILL DO

W. Kahan Oct. 1979 63 p refs
(Contract N00014-76-C-0013)
(AD-A078479; UCB/ERL-M79/61) Avail: NTIS
HC A04/MF A01 CSCL 12/1

A familiar task is to solve f(x) = 0 given a continuously differentiable real function f. Newton's iteration could be tried; so could the Secant iteration. Except when the derivative f: costs appreciably less to evaluate than does f, the Secant iteration tends in practice to converge ultimately more efficiently than Newton's whenever both iterations converge to the desired root. When will they both converge? We find roughly that whenever Newton's iteration converges from every starting point in an interval I, so must the Secant iteration converge from every pair of starting points in I provided only that f actually reverses sign in I. This is an unexpected way for the Secant iteration to dominate Newton's. GRA

N80-18816# Massachusetts Inst. of Tech., Cambridge. Information and Decision Systems Lab.

MULTIPLE INTEGRAL EXPANSIONS FOR NONLINEAR FILTERING Interim Report

S. K. Mitter and D. Ocone Sep. 1979 8 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A078490; AFOSR-79-1256TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

In their seminal paper, Fujisaki, Kallianpur and Kunita showed how the best least squares estimate of a signal contained in additive white noise can be represented as a stochastic integral with respect to innovation process, the integral being adapted to the observation process. The difficulty with this representation is that in general, this estimate is not useful for computing the estimate since the innovations process depends on the estimate of the signal itself. In this paper we discuss representation of the estimate directly in terms of the observation process. In doing so, we derive new results on multiple integral expansions for square-integrable functionals of the observation process and show the connection of this work to the theory of contraction operators on Fock space. This letter development is due to Nelson and Segal. We also present several applications of these results to determining sub-optimal filters. GRA

N80-18817# Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.

PROBABILISTIC ALGORITHMS IN FINITE FIELDS

Michael O. Rabin Jan. 1979 29 p refs
(Contract N00014-75-C-0661)
(AD-A078416; MIT/LCS/TR-213) Avail: NTIS
HC A03/MF A01 CSCL 12/1

We present probabilistic algorithms for the problems of finding an irreducible polynomial of degree n over a finite field, finding roots of a polynomial, and factoring a polynomial into its irreducible factors over a finite field. All of these problems are of importance in algebraic coding theory, algebraic symbol manipulation, and number theory. These algorithms have a very transparent, easy to program structure. For finite fields of large characteristic p, so that exhaustive search through z sub p is not feasible, or algorithms are of lower order in the degrees of the polynomial and fields in question, than previously published algorithms.GRA

N80-18818# Brown Univ., Providence, R. I. Applied Report

AN EXAMPLE OF BIFURCATION TO HOMOCLINIC ORBITS

Shui-Nee Chow (Michigan State Univ., East Lansing), Jack K. Hale, and John Mallet-Paret 1 Sep. 1979 32 p
(Grants AF-AFOSR-3092-76; NSF MCS-76-06739; NSF MCS-79-05774; DAAG27-76-G-0294; AF Proj. 2304)
(AD-A078432; AFOSR-79-1240TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

The purpose of this paper is to determine the curves in lambda-space of bifurcation to strange attractors and to relate this to hyperbolic subharmonic bifurcations. GRA

N80-18819# Florida State Univ., Tallahassee. Dept. of Statistics.

UNIFIED TREATMENT OF SOME INEQUALITIES AMONG RATIOS OF MEANS Interim Report

Emad El-Neweihi and Frank Proschan Oct. 1979 8 p refs
(Grant AF-AFOSR-3678-78; AF-AFOSR-3050-76; AF Proj. 2304)
(AD-A078464; FSU-Statistics-M524; AFOSR-79-1230TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using majorization and Schur-functions, Marshall, Olkin, and Proschan obtained a result concerning monotonicity of the ratio of means. This note shows that a slight extension of their result provides a unified method for obtaining and extending inequalities between means due to Chan, Goldberg, and Gonek, as well as deriving additional inequalties of the same type. GRA

N80-18820# Maryland Univ., College Park. Computer Vision Lab.

IMAGE MODELS Interim Report

Narendra Ahuja and Azriel Rosenfeld Jul. 1979 38 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A078468; TR-781; AFOSR-79-1158TR) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper reviews pixel-based and region-based ('structural') image models. The former include both one-dimensional time series and random field models, with the properties of the field specified either locally or globally. GRA

N80-18821# Maryland Univ. Baltimore County, Baltimore. Dept. of Mathematics.

DETECTION, ESTIMATION, AND CONTROL ON GROUP MANIFOLDS Final Report, 1 Jun. 1974 - 31 May 1979

James T. Lo 31 May 1979 22 p
(Grant AF-AFOSR-2671-74; AF Proj. 2304)
(AD-A077707; AFOSR-79-1093TR) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The results covered by this final report can be put in two categories - continuous-time systems and discrete-time systems. The continuous-time systems considered are bilinear in form. The bilinear systems have been extensively studied in recent years for three primary reasons. First, it has been shown that bilinear systems are feasible mathematical models for large classes of problems of practical importance. Second, bilinear systems provide higher order approximations to nonlinear systems than do linear systems. Third, bilinear systems have rich geometric and algebraic structures which promise a fruitful field of research. GRA

N80-18822# Florida State Univ., Tallahassee. Dept. of Statistics.

EXTREME POINTS OF CERTAIN CONVEX SUBSETS OF LOG-CONVEX FUNCTIONS

Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan Aug. 1979 18 p refs Sponsored in part by NSF, Washington, D.C.
(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)
(AD-A077549; FSU-Statistics-M519; TR-D-34-ARO;
AFOSR-78-14TR; ARO-16713.2-M) Avail: NTIS
HC A02/MF A01 CSCL 12/1

The identification of the extreme points of a convex set is an important problem in mathematics. One reason for identifying the extreme points is that they are, in many instances, the basic building blocks for the convex set. For instance, when the convex set is a compact subset of a locally convex space it is the closed convex hull of its extreme points (Krein-Milman Theorem) and if in addition the set is metrizable, any point in it has an integral representation in terms of the extreme points (Choquet's Theorem). Recently the extreme points for certain types of convex compact sets of probability distributions which occur in reliability theory have been identified. The extreme points for the set of discrete decreasing failure rate distributions are identified without appealing to Choquet's Theorem, give an explicit representation for these distributions in terms of the extreme points. It turns out that techniques employed in this last paper can be used to identify the extreme points for certain convex sets of log-convex functions. The purpose of this paper is to present these results. GRA

N80-18823# Wisconsin Univ. - Madison. Mathematics Research Center.

ON THE ESTIMATION OF FUNCTIONS OF SEVERAL VARIABLES FROM AGGREGATED DATA Summary Report

Nira Dyn and Grace Wahba Jul. 1979 39 p refs
(AD-A077105; MRC-TSR-1974) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This work was motivated by the problem of obtaining a smooth density function over a geographical region from data aggregated over irregular subregions. Minimization of a family of roughness criteria given 'volume' data lead to smooth multivariate functions Laplacian histosplines, having a certain order of the iterated Laplacian of constant value in each of the subregions and satisfying natural boundary conditions on the boundary of the region. For inexact data, e.g., in case of estimating an underlying density given counts of events by subregions, Laplacian smoothing histosplines are constructed, analogous to smoothing splines in the univariate case, and a method for choosing the smoothing parameter is presented. For both cases of exact and inexact data, modified roughness criteria, independent of the region, are discussed, and results known for point-evaluation data are extended to the case of aggregated data. GRA

N80-18824# Wisconsin Univ. - Madison. Mathematics Research Center.

FFT AS NESTED MULTIPLICATION, WITH A TWIST

Carl deBoor Jun. 1979 12 p refs
(Contract DAAG29-75-C-0024)
(AD-A077099; MRC-TSR-1968) Avail: NTIS
HC A02/MF A01 CSCL 12/1

A simple, yet complete and detailed description of the Fast Fourier Transform for general N is given, with the aim of making the underlying idea quite apparent. To help with this didactic goal, a simple twist, i.e., a shifting of information from rows to columns during the calculations, is introduced which allows to give a simple meaning to intermediate results and assures that the final results need no further reordering. GRA

N80-18825# Wisconsin Univ. - Madison. Mathematics Research Center.

A NEWTON METHOD FOR THE PIES ENERGY MODEL

Norman H. Josephy Jun. 1979 33 p refs
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A077102; MRC-TRC-1971) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. By using the theory of generalized equations, a Newton method has been developed to solve problems arising in both mathematical programming and mathematical economics. It is shown how Newton's method for generalized equations can be applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. Solutions to a simplified version of PIES are obtained using a Newton method, and comparisons are made to solutions which have appeared in the literature. GRA

N80-18826# Wisconsin Univ. - Madison. Mathematics Research Center.

HOGAN'S PIES EXAMPLE AND LEMKE'S ALGORITHM

Norman H. Josephy Jun. 1979 18 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077103; MRC-TRC-1972) Avail: NTIS
HC A02/MF A01 CSCL 12/1

Newton's method for generalized equations (Josephy (3)) was applied to the economic equilibrium problem of the Project Independence Evaluation System (PIES) Energy Model. The resulting algorithm involves solving a sequence of linear complementary problems. Lemke's complementary pivot algorithm is used for this purpose. In this paper, it is shown that the linear complementarity problems will be copositive plus when the negative of the elasticity matrix, -e, of the consumer's quantity vs. price relation has the following properties: (1) positive diagonals, (2) negative off-diagonals, and (3) strict diagonal dominance. These conditions are satisfied for Hogan's example. Thus, Lemke's algorithm will either converge to a solution or show that no solution exists. Under the conditions of Theorem 1 of Josephy, a solution to the linear complementarity problems will always exist. Hence, Lemke's algorithm can be used when the conditions of the Theorem 1 of Josephy are satisfied. GRA

N80-18827# Wisconsin Univ. - Madison. Mathematics Research Center.

GLOBAL AND SUPERLINEAR CONVERGENCE OF A CLASS OF SCALED VARIABLE METRIC METHODS

Klaus Ritter Jun. 1979 41 p refs
(Contract DAAG29-75-C-0024)
(AD-A077098; MRC-TSR-1967) Avail: NTIS
HC A03/MF A01 CSCL 12/1

This paper considers a class of variable metric methods for unconstrained minimization. The update formulas are such that the quasi-Newton equation is not necessarily satisfied. Under appropriate assumptions on the function to be minimized, each algorithm in this class converges globally and superlinearly. Many practical problems in operations research may be reduced to minimizing a function with or without constraints. By means of penalty functions and similar techniques a constrained minimization problem can be converted into a sequence of unconstrained minimization problems. GRA

N80-18828# Wisconsin Univ. - Madison. Mathematics Research Center.

QUASI-NEWTON METHODS FOR GENERALIZED EQUATIONS

Norman H. Josephy Jun. 1979 26 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077097; MRC-TSR-1966) Avail: NTIS
HC A03/MF A01 CSCL 12/1

Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. Situations arise in which it is undesirable to evaluate, at each iteration, the derivative appearing in the Newton iteration formula. In these cases, a technique of much modern interest is the quasi-Newton method, in which an approximation to the derivative is used in place of the derivative. By using the theory of generalized equations, quasi-Newton methods are developed to solve problems arising in both mathematical programming and mathematical economics. Two results concerning the convergence and convergence rate of quasi-Newton methods for generalized equations. Computational results of quasi-Newton methods applied to a nonlinear complementarity problem of Kojima. GRA

N80-18829# Wisconsin Univ. - Madison. Mathematics Research Center.

CALCULATING CONSTRAINTS ON RELATIONAL EXPRESSIONS

A. Klug May 1979 84 p refs
(Contract DAAG29-75-C-0024)
(AD-A077092; MRC-TSR-1961) Avail: NTIS
HC A05/MF A01 CSCL 12/1

A desirable feature of a database management system is the ability to support many views of the database via several user models. In order to provide this support while allowing the user to believe that his/her view and data model are the only ones, the database system must have a number of facilities. One of the most important of these is a mechanism to tell when view constraints will be satisfied given that the underlying database constraints are satisfied so that the user always sees what is expected. This paper deals with a particular instance of this problem where the constraints are functional dependencies and the views are created through relational algebra expressions. The problem immediately reduces to the problem of calculating all valid functional dependencies (and other constraints) on a relational algebra expression over relations in the base schema. The problem is undecidable in general but we give a sound and complete algorithm when set difference is omitted from relational algebra. GRA

N80-18830# Wisconsin Univ. - Madison. Mathematics Research Center.
NEWTON'S METHOD FOR GENERALIZED EQUATIONS Summary Report
Norman H. Josephy Jun. 1979 37 p refs
(Contract DAAG29-75-C-0024; Grants NSF MCS-74-20584; NSF DCR-74-20584)
(AD-A077096; MRC-TSR-1965) Avail: NTIS HC A03/MF A01 CSCL 12/1

Newton's method is a well known and often applied technique for computing a zero of a nonlinear function. By using the theory of generalized equations, a Newton method is developed to solve problems arising in both mathematical programming and mathematical economics. Two results concerning the convergence and convergence rate of Newton's method are proved for generalized equations. Examples are given to emphasize the application of this method to generalized equations representing the non-linear programming problem and the nonlinear complementarity problem. Computational results of Newton's method applied to a nonlinear complementarity problem of Kojima, and an invariant capital stock problem of Hansen and Koopmans are both presented. GRA

N80-18831# Battelle Human Affairs Research Centers, Seattle, Wash.
JACKKNIFE, RIDGE AND ORDINARY LEAST SQUARES ESTIMATORS OF REGRESSION PARAMETERS: A MONTE CARLO COMPARISON
Michael K. Lindell Sep. 1979 32 p refs
(Contract N00014-77-C-0127)
(AD-A077724; B-HARC-422-031) Avail: NTIS HC A03/MF A01 CSCL 12/1

This study reports the results of a Monte Carlo evaluation of the small sample performance of ordinary least squares OLS, ridge and jackknife estimators of regression coefficients. The primary criteria of evaluation are the mean square error MSE of the regression coefficients and the size of the t-statistics associated with these coefficients. The conditions studied are derived from a design in which two factors are varied the sample size to number of predictors N/P ratio and the metric quality of the data dichotomous and polychotomous. Results from 500 replications of each of six cells showed that OLS and jackknife estimators did not differ appreciably on either criterion. Ridge weights had substantially smaller MSE at the lowest levels of N/P 51. At high levels of N/P 201, ridge weights had a slightly greater MSE than either OLS and jackknifed weights. A dilemma in the use of t-statistics for ridge weights is presented. GRA

N80-18832# Texas Univ. at Austin.
SMOOTHING AND APPROXIMATION OF MULTIVARIATE FUNCTIONS Final Report, 10 Sep. 1977 - 9 Sep. 1979
E. W. Cheney 31 Oct. 1979 10 p refs
(Grant DAAG29-77-G-0215)
(AD-A078640; ARO-14900.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The goal of the research project was to proceed as far as possible in the study of a certain class of practical approximation problems. Namely, the problem is to reduce the complexity of multivariate functions by representing them precisely or approximately by combinations of univariate functions. A prototype problem is that of finding a best approximation to a function of two variables, F(x,Y), by a sum g(x) H(y). The prototype problem is thoroughly understood in the case that the functions involved are continuous and an approximation in the uniform sense is needed. GRA

N80-18833# Texas Univ. at Austin. Center for Cybernetic Studies.
A LINEAR PROGRAMMING APPROACH TO A SIMPLE LINEAR REGRESSION PROBLEM WITH LEAST ABSOLUTE VALUE CRITERION
R. D. Armstrong and M. T. Kung Sep. 1979 15 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569)
(AD-A078622; CCS-351) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a linear programming approach to solve simple linear regression problems with the least absolute value criterion. The solution technique uses linear programming with an extended minimum ratio rule. A computational study indicates the efficiency of the algorithm. GRA

N80-18834# Princeton Univ., N. J. Dept. of Statistics.
ASYMPTOTIC INFERENCE FOR EIGENVECTORS
David E. Tyler Oct. 1979 27 p refs
(Contracts N00014-67-A-0151; N00014-75-C-0453; Grants DAHC04-74-G-0178; ERDA-E-111-2310)
(AD-A078960; TR-157-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Asymptotic procedures are given for testing certain hypotheses concerning eigenvectors and for constructing confidence regions for eigenvectors. These asymptotic procedures are derived under fairly general conditions on the estimates of the matrix whose eigenvectors are of interest. Applications of the general results to principal components analysis and canonical variate analysis are given. GRA

N80-18835# Princeton Univ., N. J. Dept. of statistics
AN IMPLICIT FUNCTION THEOREM FOR GROUP EQUATIONS GENERATED BY A FINITE AUTOMATION
Philip R. Thrift Aug. 1979 10 p refs
(Contract N00014-79-C-0322)
(AD-A078959; TR-150-Ser-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

The study of mathematical semantics involves the study of mappings from a formal language L to a configuration space C. In this paper we consider the special case where L = L(D), D is a finite automaton, C is a group G, and the semantic map is defined by associating each production of D with a group element of G, p approaches theta (P). A sequence of productions would then be mapped to a product of corresponding group elements. When the semantic map is observed on sentences in L(D), we discuss a graph-theoretic method of solving for theta. GRA

N80-18836# Kentucky Univ., Lexington. Dept. of Mathematics.
REALIZATION THEORY FOR MULTIVARIATE GAUSSIAN PROCESSES, 2: STATE SPACE THEORY REVISITED AND DYNAMICAL REPRESENTATIONS OF FINITE DIMENSIONAL Interim Report
Anders Lindquist and Giorgio Picci Jul. 1979 30 p refs
Presented at the 2d Intern. Conf. on Inform. Sci. and Systems, Patras, Greece, 9-14 Jul. 1979
(Grants AF-AFOSR-3519-78; NSF Eng-79-03731; AF Proj. 2304)
(AD-A078749; AFOSR-79-1275TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is twofold. First, some of the results of Part I are generalized and clarified, reformulated in a mathematical framework which we now perceive as more natural and conceptually sounder, the basic concept being perpendicularly intersecting subspaces. By relating minimality of stochastic realizations to the factorization of certain Hankel operators, the connections to deterministic realization theory is further clarified. Furthermore, spectral domain criteria for minimality, observability and constructibility are presented. Secondly, stochastic differential equation representations are presented for all state spaces which are finite dimensional. The infinite dimensional case will be the topic of Part III of this sequence of papers. GRA

N80-18837# Florida Univ., Gainesville. Center for Mathematical System Theory.
MATHEMATICAL TECHNIQUES FOR NONLINEAR SYSTEM THEORY
R. E. Kalman and E. Emre May 1979 2 p
(Contract AF-AFOSR-3034-76; AF proj. 2304)
(AD-A078715; AFOSR-79-1255TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The main topic of research concerned various algebraic characterizations of F mod G invariant subspaces in linear systems. Module-theoretic characterizations of these subspaces were obtained which showed among other results, that a module structure can be defined maximally on the ratio of V to R where

V is the maximal F mod G invariant subspace contained in the Kernal of H and R is the analogous maximal reachability subspace. A final solution of the so-called partial realization problem was obtained. GRA

N80-18838# Florida State Univ., Tallahassee. Dept. of Statistics.
THE EXTREME POINTS OF THE SET OF DECREASING FAILURE RATE DISTRIBUTIONS Interim Report
Naftali A. Lungberg, Ramon V. Leon, James Lynch, and Frank Proschan Aug. 1979 18 p refs Revised
(Grants AF-AFOSR-3678-78; NSF MCS-79-04698; AF Proj. 2304)
(AD-A078774; FSU-Statistics-M484-Rev; TR-78-5-Rev; AFOSR-79-1219TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Since the class of extended decreasing failure rate (EDFR) life distributions (i.e., distributions with support in (0, infinity)) is compact and convex, it follows from Choquet's Theorem that every EDFR life distribution can be represented as a mixture of extreme points of the EDFR class. We identify the extreme points of this class and of the standard class of decreasing failure rate (DFR) life distributions. Further, we show that even though the convex class of DFR life distributions is not compact, every DFR life distribution can be represented as a mixture of extreme points of the DFR class. GRA

N80-18839# California Univ., Los Angeles. Dept. of Mathematics.
PROBLEM IN STABILITY ANALYSIS OF FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS Interim Report, 6 Jan. 1978 - 31 May 1979
Moshe Goldberg 1979 6 p refs
(Grant AF-AFOSR-3046-76; AF Proj. 2304)
(AD-A078853; AFOSR-79-1285TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research consists mainly of generalizing previous work to obtain new, easily checkable stability criteria for general, dissipative or nondissipative, explicit or implicit difference approximations to hyperbolic mixed initial-boundary value problems. The criteria obtained are independent of the basic scheme and are given solely in terms of the boundary conditions; thus they are significantly more convenient than traditional criteria. The results imply that many well known boundary conditions, when used in combination with arbitrary dissipative or nondissipative schemes, always maintain stability. GRA

N80-18840# Wisconsin Univ. - Madison. Mathematics Research Center.
AN ENERGETIC APPROACH TO HOMOGENIZATION PROBLEMS WITH RAPIDLY OSCILLATING POTENTIALS Summary Report
Hedy Attouch Aug. 1979 52 p refs
(Contract DAAG29-75-C-0024)
(AD-A077134; MRC-TSR-1989) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is shown that many, a priori distinct, problems of homogenization including the case of rapidly oscillating potentials can be studied, and the limit problem computed, in a unified way, through general compactness and convergence results for sequences of functionals of calculus of variations. The convergence notion is taken in variational sense, more precisely by the notion of Gamma-convergence introduced by De-Giorgi. GRA

N80-18841# Wisconsin Univ. - Madison. Mathematics Research Center.
A GLOBALLY AND QUADRATICALLY CONVERGENT ALGORITHM FOR GENERAL NONLINEAR PROGRAMMING PROBLEMS Summary Report
Michael J. Best (Waterloo Univ., Ontario), Jurgen Brauninger (Stuttgart Univ., W. Germany), Klaus Ritter (Stuttgart Univ., W. Germany), and Stephen M. Robinson Jul. 1979 22 p refs Sponsored in part by NSF
(Contract DAAG29-75-C-0024; Grant NSF MCS-74-20584)
(AD-A077104; MRC-TSR-1973) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents an algorithm for the minimization of a nonlinear objective function subject to nonlinear inequality and equality constraints. The proposed method has the two distinguishing properties that, under weak assumptions, it converges to a Kuhn-Tucker point for the problem and under somewhat stronger assumptions, the rate of convergence is quadratic. The method is similar to a recent method proposed by Rosen in that it begins by using a penalty function approach to generate a point in a neighborhood of the optimum and then switches to Robinson's method. The new method has two new features not shared by Rosen's method. First, a correct choice of penalty function parameters is constructed automatically, thus guaranteeing global convergence to a stationary point. Second, the linearly constrained subproblems solved by the Robinson method normally contain linear inequality constraints while for the method presented here, only linear equality constraints are required. That is, in a certain sense, the new method 'knows' which of the linear inequality constraints will be active in the subproblems. The subproblems may thus be solved in an especially efficient manner. Preliminary computational results are presented. GRA

N80-18842# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
REMARKS ON THE CALCULATION OF THE KERNEL APPROXIMATION IN UNSTEADY AERODYNAMICS [REMARQUES SUR LE CALCUL DU NOYAU EN AERODYNAMIQUE INSTATIONNAIRE]
R. Barreau Paris Assoc. Aeron. et Astronautique de France 1979 35 p refs In FRENCH Presented at 15th Colloq. d'Aerodyn. Appl., Marseille, 7-9 Nov. 1978
(Contract DRET-78-34-113-00)
(AAAF-NT-79-07; ISBN-2-7170-0534-X) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 29 (France and EEC) FF 33 (others)

Different analytic methods used in the calculation of unsteady aerodynamic forces are briefly reviewed. Emphasis is placed on calculating time and obtainable numerical precision of the inherent approximation. A kernel function method for deriving the approximations is then presented. In order to realisticaly compare the calculation of the integrals used in the different methods a computer program was used. Results show the kernel method to be twice as fast as any other method tried. Author (ESA)

N80-18843# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
IMPERFECT BIFURCATION AND BANACH SPACE SINGULARITY THEORY
Leif Arkyerd 1979 24 p refs Prepared in cooperation with Goeteborg Univ.
(CTH-Math-1979-12) Avail: NTIS HC A02/MF A01

The theory of imperfect bifurcation via singularity theory as developed to a Banach space setting is generalized. Banach control spaces which allow a useful uniform control of function parameters through universal unfolding are discussed. Among the results are tests for various germ properties and a discussion of their reducibility under a Liapunov-Schmidt type plitting, as well as a generalization of the finite dimensional unfolding and germ classification theory. Author (ESA)

N80-18844# Polytechnical Univ. of Madrid (Spain). Escuela Tecnica Superior de Ingenieros Telecommunication.
NUMERICAL INTEGRATION OF A CLASS OF SINUSOIDAL FUNCTIONS WHOSE ARGUMENT IS THE INTEGRAL OF A MONOTONIC INCREASING FUNCTION
J. Rivero Laguna, R. Diazdelaiglesia, A. Castillo Holgado, and J. M. Hernando Rabanos Feb. 1979 10 p refs In SPANISH; ENGLISH summary
Avail: NTIS HC A02/MF A01

A procedure for the evaluation of the integral from zero to T of cos Theta(t) dt, with T constant, where Theta (t) = the integral from zero to t of 2 eta f(zero) + f(d)(u) du, is presented. Numerical methods are used when f(d)(u) is a nonotonic increasing function. Three kinds of functions were studied: linear, tangetial, and hyperbolic. Results can be generalized to other functions. It is also possible to generalize the method to nonotonic decreasing functions with some modifications. Based on the subintegral function chosen, a rule is established for determining the number of integration sub-intervals necessary to meet a relative error criterion. The use of different methods of numerical integration is considered. Application of the method to the calculation of the Fourier transformation spectrum of a modulated FM-Chirp signal is suggested. Author (ESA)

N80-18845# International Business Machines S. A. E., Madrid (Spain). Scientific Center.
A CENTER-COVARIANCE ADAPTIVE CLUSTERING ALGORITHM
F. Orti Jun. 1978 76 p refs Original contains color illustrations
(IBM-SCR-02.78; ISBN-84-3600-046-3) Avail: NTIS HC A05/MF A01

A clustering algorithm, using a proximity measure as a weighted Euclidean distance in which the weight matrix is the inverse of the estimated covariance matrix for each cluster, is presented. Each sample is assigned to the cluster for which this weighted distance is minimum, provided that this minimum does not exceed a given threshold. Otherwise a new cluster with center in the sample is started, unless a given maximum number of clusters has been reached, in which case the sample is rejected and stored for later processing. The number of clusters is controlled by the periodic invocation of a merger routine (to merge clusters very near each other) and an elimination routine to get rid of clusters with very low densities. Several passes through the data are made until the percentage of rejected samples is low, or until a given number of passes is attained. After the clustering run is performed a post-run analysis is made to decide whether some clusters should be merged or not based on a statistical test. Result of some clustering runs on two generated data sets and a LANDSAT image are presented. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-18846 Texas Technological Univ., Lubbock.
ERROR RATES IN POISSON DISCRIMINATION Ph.D. Thesis
Mohammed Abdullah Shayib 1979 58 p
Avail: Univ. Microfilms Order No. 8003224

The optimal, actual, and plug-in error rates of allocation between two Poisson populations differing only in the value of the parameter are investigated. The optimal error rate can be found when the parameter is known, while for the other error rate calculations, the parameter has to be estimated. In the actual error rate the estimated value of the parameter is used in dividing the sample space only. In the plug-in estimate, the estimated value of the parameter, in addition to dividing the sample space, is used to estimate the probability density function. Results of a simulation study undertaken to estimate the error rates, check their variation, divide the sample space, and investigate sample size requirements are tabulated and plotted. Dissert. Abstr.

N80-18847 Wisconsin Univ. - Madison.
BAYES SEQUENTIAL ESTIMATION PROCEDURES FOR LIFE TESTING PROBLEMS Ph.D. Thesis
Evan Eva Chen 1979 76 p
Avail: Univ. Microfilms Order No. 8001130

Statistical problems which arise when nonnegative observations become available in an ordered manner (life testing problems) are studied. The life testing problem with M machines and exponential lifetime distribution is introduced. Optimal stopping times are found for both the continuous time and discrete time approach and the results are extended to the Weibull distribution failure model. The asymptotic sampling theory properties of the Bayes sequential procedure are given and asymptotic normality of the Bayes estimator is also proven. Finally the Bayes fixed sample size procedure is defined and compared to the Bayes sequential procedure by computing the ratio of the expected total costs associated with the two procedures. By assuming a sampling cost and a set up cost, numerical results on the optimal choice of the number of machines to be put on test are given. Dissert. Abstr.

N80-18848 Texas A&M Univ., College Station.
COMBINATORIC CLASSIFICATION OF MULTIVARIATE NORMAL OBSERVATION VECTORS Ph.D. Thesis
Charles Leslie Dunn 1979 103 p
Avail: Univ. Microfilms Order No. 8003123

The problem of classifying an observation vector as coming from one of two multivariate normal distributions which differ both in their mean vectors and covariance matrices is considered. A search for the procedure which minimizes the expected cost of misclassification is conducted within the class of procedures based upon a certain combination of n independent univariate discriminations. An efficient search of this class of procedures is made by employing an algorithm of the implicit enumeration type used in integer programming. In the case of known population parameters, the independent discriminant functions and exact probabilities of misclassification are found. When the parameters are unknown estimates are introduced for the coefficients of each univariate discriminant function and for the probabilities of misclassification. A jackknife procedure is introduced in order to improve the estimation process. The method is applied to the problem classifying a set of male twins as to whether they are monozygotic or dizygotic. Dissert. Abstr.

N80-18849 Montana State Univ., Missoula.
USING INCOMPLETE MULTIVARIATE DATA TO SIMULTANEOUSLY ESTIMATE THE MEANS Ph.D. Thesis
Susan Marie Hinkins 1979 109 p
Avail: Univ. Microfilms Order No. 8003718

A Bayes and an empirical Bayes estimator of the mean vector from a multivariate normal data set with missing observations are presented. Both estimators resemble the ridge-regression estimate, which shrinks the maximum likelihood estimate towards an a priori mean vector. Both estimators are consistent for and asymptotically equivalent to the maximum likelihood estimate. Small sample properties of the Bayes estimator are found, including conditions under which it has smaller risk than the maximum likelihood estimate. Numerical examples indicate that under some conditions the empirical Bayes estimator may also improve on the maximum likelihood estimator. Two computer programs which provide useful methods for estimation when there are data missing are also presented. The program RFACTOR creates Rubin's factorization table. The program MISSMLE calculates the maximum likelihood estimates of the mean vector and variance-covariance matrix from a multivariate normal data set with missing data. Dissert. Abstr.

N80-18850 Indiana Univ., Bloomington.
THE EFFECTS OF SELECTED GRAPHIC DESIGN VARIABLES ON THE READABILITY OF MULTIPLE-LINE GRAPHS Ph.D. Thesis
George Wesley Bostick, Jr. 1979 62 p
Avail: Univ. Microfilms Order No. 8003838

The separate and joint effects of three graphic design variables on the readability of multiple line graphs were examined. The three variables, each having two levels, were: (1) the method of representing scale markings, the levels being ruled grid and tick marks; (2) the method of representing data lines, the levels being line code and symbol code; and (3) the method of identifying data lines, the levels being labels and key. The three independent variables were combined in a (2)(2)(2) factorial design with repeated measures on all three variables. A multiple line graph was constructed depicting the fictional market values over time of four different agricultural exports to represent each of the eight experimental conditions. Each of the resulting eight graphs was identical except with respect to the combination of levels of the three independent variables. Dissert. Abstr.

N80-18851# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
ON THE WEAK CONVERGENCE OF A SEQUENCE OF GENERAL STOCHASTIC DIFFERENCE EQUATIONS TO A DIFFUSION
H. J. Kushner and Hai Huang Oct. 1979 41 p refs
(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-77; NSF ENG-77-12946)
(AD-A078583; LCDS-TR-79-6) Avail: NTIS HC A03/MF A01 CSCL 12/1

A convenient and useful method for showing weak convergence, to a diffusion, of the interpolated solutions of a (not necessarily Markovian) sequence of stochastic difference equations is developed. The technique involves the use of averaging methods to show that the weak limit satisfies the martingale problem of Strook and Varadhan which is associated with the diffusion. A truncation method is developed so that it is only necessary to work with the parts of the process before first escape from an arbitrary but bounded domain. The assumptions cover a wide variety of applications in systems theory, mathematical biology and elsewhere, but the method of proof is adaptable to other special cases where our particular assumptions might not hold. Two applications are given in order to illustrate the relative ease of use of the method. The driving noise process in the difference equations can depend on the solution process of the difference equation, and one application where this is useful is given (a rate of convergence problem for simple stochastic approximations with sequentially averaged observations). GRA

N80-18852# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ON THE CUMULANTS OF CUMULATIVE PROCESSES
Walter L. Smith Oct. 1979 51 p refs
(Contract N00014-76-C-0550)
(AD-A078474; MIMEO-Ser-1257) Avail: NTIS HC A04/MF A01 CSCL 12/1

Cumulative processes were introduced in 1955 as a natural concomitant to the study of what the author called regenerative processes (Smith, 1955). In that first paper some basic results concerning cumulative processes were obtained; these were also explained, and the notions of cumulative and regenerative processes further detailed, in Smith (1958). For the purpose of the present discussion, the cumulative process is presented. GRA

N80-18853# Brown Univ., Providence, R. I. Center for Dynamical Systems.
ON A STOCHASTIC CONTROL PROBLEM WITH EXIT CONSTRAINTS Interim Report
Martin Day Jun. 1979 17 p refs
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A078372; AFOSR-79-1165TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper the logarithmic transformation of Fleming is used to discuss a specific problem of controlled diffusions. The problem is to minimize a certain quadratic functional of the applied drift while satisfying the requiremont that the place where the process exists a domain is not in a specified subset of its boundary. The main result is that the solution of this problem is given by the logarithm of a related exit probability. GRA

N80-18854# Minnesota Univ., Minneapolis. School of Statistics.
OPTIMUM RULES FOR CLASSIFICATION INTO TWO MULTIVARIATE NORMAL POPULATIONS WITH THE SAME COVARIANCE MATRIX
Somesh DasGupta Oct. 1979 25 p refs
(Contract DAAG29-76-C-0038)
(AD-A077565; TR-359; ARO-13149.9-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

For the problem of classifying an observation into one of the two p-variate normal distributions with the same covariance matrix, various optimal rules are given for different situations depending on the knowledge of the parameters involved. GRA

N80-18855# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.
SIMILARITY MEASURES ON BINARY ATTRIBUTE DATA
M. F. Janowitz Nov. 1979 44 p refs
(Contract N00014-79-C-0629)
(AD-A077627; TR-J7901) Avail: NTIS HC A03/MF A01 CSCL 12/1

The ability of commonly used similarity coefficients to recapture natural classifications in the presence of various types of errors is investigated by means of several computer simulations of a certain model of the classification problem. The goal is to establish the relative merits of the phylogenetic versus the phenetic methods of classification. GRA

N80-18856# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPTIONAL SAMPLING OF SUBMARTINGALES INDEXED BY PARTIALLY ORDERED SETS Interim Report
Robert Washburn, Jr. (Scientific Systems, Cambridge, Mass.) and Alan S. Willsky Oct. 1979 46 p refs
(Grant AF-AFOSR-3281-77)
(AD-A077409; LIDS-P-953; AFOSR-79-1153TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The optional sampling theorem for martingales indexed by a partially ordered set is true if the index set is directed. However, the corresponding result for submartingales indexed by a partially ordered set is generally false. In this paper we completely characterize the class of stopping times for which the optional sampling theorem is true for all uniformly bounded submartingales indexed by countable partially ordered sets. By assuming a conditional independence property, we show that when the index set is R to the 2nd power the optional sampling theorem is true for all uniformly bounded submartingales and all stopping times. This conditional independence property is satisfied in cases where the submartingales and stopping times are measurable with respect to the two-parameter Wiener process. A counter example shows that the optional sampling result is false for R to the n power when n greater than 2 even if the conditional independence property is satisfied. GRA

N80-18857# Iowa Univ., Iowa City. Div. of Educational Psychology.
THE ROLE OF EXCHANGEABILITY IN INFERENCE Research Report, 1 Jun. 1977 - 1 Aug. 1979
D. V. Lindley and Melvin R. Novick Aug. 1979 49 p refs
(Contract N00014-77-C-0428; RR0420401)
(AD-A077378; TR-79-8) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with basic problems of statistical inference. The thesis is in three parts: (1) that inference is a procedure whereby one passes from a population (or sample) to a new individual; (2) that this connection can be established using de Finetti's idea of exchangeability or Fisher's concept of a subpopulation; and (3) in making the connection use must be made of the appropriate probability. These three principles are used in a variety of situations and the topics discussed include analysis of variance and covariance, contingency tables, and calibration. Some comments on randomization are also included. GRA

N80-18858# University of Southern California, Los Angeles. Social Science Research Inst.
RANK WEIGHTING IN MULTIATTRIBUTE UTILITY DECISION MAKING: AVOIDING THE PITFALLS OF EQUAL WEIGHTS Technical Report, Dec. 1978 - Dec. 1979
William G. Stillwell and Ward Edwards Sep. 1979 52 p refs
(Contract N00014-79-C-0038)
(AD-A078941; USC-001595-2T; SSRI-RR-79-2) Avail: NTIS HC A04/MF A01 CSCL 12/1

The notion of 'dominance' in multiattribute utility decision contexts leads to a change in the considered alternative set. The implications of this set change are discussed in relation to the conditions of Wainer's (Wainer, 1976) 'equal weights theorem' and the resulting sensitivity to weighting of importance dimensions demonstrated. Data from three multiattribute decision making studies are examined using four rank weighting techniques as well as equal weights. Rank weighting of importance dimensions demonstrate marked improvement of approximation as reflected in both Pearson and rank order correlations for measures of overall utility across alternatives within the nondominated subset. Implications for multiattribute utility application are discussed. GRA

N80-18859# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
THE ASYMPTOTIC DISTRIBUTION OF MORTALITY RATES IN COMPETING RISKS ANALYSES
Joseph C. Gardiner Dec. 1979 16 p refs
(Contract N00014-79-C-0522; Grant BSRG-S07-RR07049-14)
(AD-A078948; RM-405) Avail: NTIS HC A02/MF A01 CSCL 12/1

For a sample of individuals from an animal or human population under observation in a clinical trial or life test, mortality rates are defined for each risk to which the population is exposed. By considering only the crude risk functions and cause-specific failure rates in a basic competing risks model, these mortality rates are shown to have an asymptotic normal distribution. An expression for the asymptotic correlation between a pair of mortality rates is thus obtained and a necessary and sufficient condition for their asymptotic independence is investigated in some general situations with reference to only the cause-specific failure rates and the survival function of the individuals. GRA

N80-18860# University of Western Michigan, Kalamazoo. Dept. of Mathematics.

A WEIGHTED DISPERSION FUNCTION FOR ESTIMATION IN LINEAR MODELS

Gerald L. Sievers Oct. 1979 39 p refs
(Contract N00014-78-C-0637)
(AD-A077654; Mathematics-62) Avail: NTIS HC A03/MF A01 CSCL 12/1

Robust estimates for the parameters in the general linear model are proposed which are based on weighted rank statistics. The method is based on the minimization of a dispersion function defined by a weighted Gini's mean difference. An asymptotic distribution of the estimate is derived. Some examples are discussed which point out that the ranking can be based on a restricted set of comparisons and still retain high efficiency.GRA

N80-18861# Tennessee Univ., Knoxville. Dept. of Psychology.

CONVERGENCE OF THE CONDITIONAL DISTRIBUTION OF THE MAXIMUM LIKELIHOOD ESTIMATE, GIVEN LATENT TRAIT, TO THE ASYMPTOTIC NORMALITY: OBSERVATIONS MADE THROUGH THE CONSTANT INFORMATION MODEL

Fumiko Samejima Oct. 1979 116 p refs
(Contract N00014-77-C-360; RR0420401; NR Proj. 150-402)
(AD-A077706; RR-79-3) Avail: NTIS HC A06/MF A01 CSCL 12/1

The Constant Information Model can be used when we substitute a subset of equivalent, binary items, whose item characteristic functions are unknown, for the Old Test, or a subset of test items whose operating characterictics are known, in estimating the operating characteristics of item response. In so doing, it has been suggested that we choose items whose common discrimination power is low, so that the interval of latent trait, for which their common item characteristic functions in the Constant Information Model assumes positive values, is wide enough to cover the ability levels of all the examinees on which the operating characteristics of new items are to be estimated. This suggestion needs more investigation and precision, however, since it is expected from theory that the convergence of the conditional distribution of the maximum likelihood estimate, given latent trait, to the normality is slow for the values of latent which are close to the two endpoints of the above interval, in comparison with those close to the midpoint. In this paper, through a simulation study, the speed of convergence of the conditional distribution of the maximum likelihood estimate to the normality at various levels of latent trait is observed, using 20 hypothetical test sessions, in each of which 10 equivalent, binary test items are given. As was expected, the conditional distribution of the maximum likelihood estimate is skewed for the values of latent trait close to the two endpoints of the interval and the convergence is slower. GRA

N80-18862# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

MAXIMUM LIKELIHOOD ESTIMATION OF A DISTRIBUTION FUNCTION WITH MONOTONE FAILURE RATE BASED ON CENSORED OBSERVATIONS Interim Report

W. J. Padgett and L. J. Wei Jun. 1979 18 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077459; AFOSR-79-1035TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The maximum likelihood estimator of a distribution function with monotone failure rate is derived based on a set of observations subject to arbitrary right censorship. This estimator is defined everywhere on the positive real line while the Kaplan-Meier estimator may not be. The small sample properties of this estimator are indicated by results of a Monte Carlo study for the Weibull distribution. GRA

N80-18863# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

A BAYESIAN NONPARAMETRIC ESTIMATOR OF SURVIVAL PROBABILITY ASSUMING INCREASING FAILURE RATE Interim Report

W. J. Padgett and L. J. Wei Aug. 1979 21 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077458; TR-42; AFOSR-79-1033TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Bayesian nonparametric estimators of the survival function, the failure rate function, and the density function are obtained using jump processes as prior distributions on the space of increasing failure rate functions. The jump processes are more appealing intuitively than previously used Dirichlet processes, integral gamma process, and processes neutral to the right and have a meaningful physical interpretation. Examples are given and the estimates are compared with the maximum likelihood estimates. In addition, the Bayesian nonparametric estimators are presented for arbitrarily right-censored observations.
Author (GRA)

N80-18864# South Carolina Univ., Columbia. Dept. of Mathematics, Computer Science and Statistics.

CONVERGENCE OF WEIGHTED SUMS OF RANDOM ELEMENTS IN TYPE p SPACES Interim Report

Robert Lee Taylor Jul. 1979 23 p refs
(Contract F49620-79-C-0140; AF Proj. 2304)
(AD-A077438; TR-43; AFOSR-79-1034TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The study of probability density estimation led to estimates in the form of averages or weighted sums of random variables whose values are in function spaces (Parzen (1962) and Rosenblatt (1971)). As a application of the law of the iterated logarithm in linear measurable spaces, Kuelbs (1978) considered the rates of convergence in these density estimates. The estimates are not always averages of sequences of random elements in a Banach space but are more often weighted sums of arrays of random elements where the weights are not necessarily Toeplitz matrices. In this paper the convergence of weighted sums of arrays of random elements in Banach spaces of type p is obtained both in probability and almost surely. As corollaries these results have forms of Pruitt's (1963) and Rohatgi's (1971) results for Banach spaces and also have extensions for the results of Padgett and Taylor (1976). However, exact statements of the theorems are related to the possible applications for density estimation. GRA

N80-18865# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

ON A CONJECTURE CONCERNING LEAST FAVORABLE CONFIGURATIONS IN CERTAIN TWO-STAGE SELECTION PROCEDURES

Klaus-J. Miescke and Joachim Sehr (Maine Univ.) Oct. 1979 16 p refs
(Contract N00014-75-C-0455)
(AD-A077591; MMS-79-29) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given k normal populations with unknown means and a common known (or unknown) variance a two-stage procedure P sub 1 with screening in the first stage to find the population with the largest mean is under concern. It was proposed and studied previously by Cohen (1959), Alam (1970), Tamhane and Bechhofer (1977, 1979) and Gupta and Miescke (1979). But up to now a conjecture concerning least favorable parameter configurations in an indifference zone approach remained unproved for k = or > 3. In this paper we give a non-standard proof of the conjecture in case of k = 3 for P sub 1 which (under minor changes) works also for a simplified version P sub 2. Besides, the point is exposed where another (more intuitive) method of proof fails to work. GRA

N80-18866# Ohio State Univ., Columbus. Dept. of Statistics.

ANALYSIS OF VARIANCE WITH UNEQUAL VARIANCES

Edward J. Dudewicz and Thomas A. Bishop Nov. 1979 15 p refs
(Contract N00014-78-C-0543)

(AD-A077653; TR-193) Avail: NTIS HC A02/MF A01 CSCL 12/1

Analysis of variance (ANOVA) is often used in quality control studies. It assumes equal variabilities within groups, and no exact procedures have been available for cases with unequal variabilities. In this paper exact procedures are given and illustrated. An indication of the losses to be incurred by using the traditional F-test when variances are unequal is given. Author (GRA)

N80-18867# North Carolina Univ. at Chapel Hill. Dept. of Statistics.

NONPARAMETRIC REGRESSION BASED ON THE CONCOMITANTS OF ORDER STATISTICS Interim Report

Gordon Johnston Sep. 1979 16 p refs
(Grant AF-AFOSR-2796-75; AF Proj. 2304)
(AD-A077636; Mimeo-Ser-1249; AFOSR-79-1099TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The properties of nonparametric regression function estimates based on the concomitants of order statistics are investigated. GRA

N80-18868# Royal Netherlands Meteorological Inst., De Bilt.

LOGISTIC DISCRIMINANT ANALYSIS [DE LOGISTISCHE DISCRIMINANT ANALYSE]

S. Kruizinga 1978 19 p refs In DUTCH
(KNMI-V-310) Avail: NTIS HC A02/MF A01

Applications of the discriminant analysis method as a translation technique in weather forecasting are described. A linear function of the entry variables is used to arrive at a decision regarding the expected variable. In some cases, the yes/no decision is not followed, but an attempt is made to specify the probability of occurence independently of the entry variable. On this basis, further decisions are possible. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-18869*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONTROL SYSTEM DESIGNS FOR THE SHUTTLE INFRARED TELESCOPE FACILITY

J. David Rowell (Stanford Univ., Calif.), Eric K. Parsons (Stanford Univ., Calif.), and Kenneth R. Lorell Feb. 1980 40 p refs
(NASA-TM-81159; A-8018) Avail: NTIS HC A03/MF A01 CSCL 12B

The Shuttle Infrared Telescope Facility (SIRTF) image motion compensation system is described in detail and performance is analyzed with respect to system noise inputs, environmental disturbances, and error sources such as bending and feedforward scale factor. It is concluded that the SIRTF accuracy and stability requirements can be met with this design. K.L.

N80-18870# California Univ., Berkeley. Operations Research Center.

ASYMPTOTIC MEASURES OF SYSTEM PERFORMANCE UNDER ALTERNATIVE OPERATING RULES, 2

Richard E. Barlow and Esther Sid Hudes Jun. 1979 29 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A078827; ORC-79-7) Avail: NTIS HC A03/MF A01 CSCL 12/2

This is the second part of a study of stochastic processes generated by failures and repairs of components in a series system. In particular, we consider a two component series system where failure of component 1 shuts off component 2 but not vice versa. In Part I, selected measures of system performance were calculated for general failure and repair distributions as implicit functions of system availability. In order to obtain explicit results, we assume in this part that either component 1 or component 2 has exponential failure and repair distributions. For the case where component 1 has a general failure distribution, we obtain counter-intuitive results concerning the long run average of system uptimes. Intuitively, it is best to shut off an operating component when the system is down. However, this is not correct if the component failure distribution is IFR (or more generally NBUE) and we wish to maximize the long run average of system uptimes. We use the method of supplementary variables to obtain explicit results for important special cases. GRA

N80-18871# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.

A HYBRID METHOD FOR THE SOLUTION OF SOME MULTI-COMMODITY SPATIAL EQUILIBRIUM PROBLEMS Management Sciences Research Report

Jong-Shi Pang Nov. 1979 28 p refs
(Contract N00014-75-C-0621)
(AD-A078514; MSRR-450; WP-35-79-80) Avail: NTIS HC A03/MF A01 CSCL 12/2

A unified formulation of the multi-commodity transportation and transshipment spatial equilibrium models has been devised as a linear complementarity problem with certain block structure. It is shown that a block successive overrelaxation method is applicable for solving the resulting complementarity problem. The method consists of solving a sequence of subproblems of the single-commodity type. These subproblems are to be solved by a special-purpose principal pivoting algorithm developed in an earlier paper. Computational experience of solving some fairly large problems by the proposed hybrid method is presented. GRA

N80-18872# California Univ., Berkeley. Operations Research Center.

ASYMPTOTIC MEASURES OF SYSTEM PERFORMANCE UNDER ALTERNATIVE OPERATING RULES, 1

Richard E. Barlow and Esther Sid Hudes Jun. 1979 44 p refs
(Grant AF-AFOSR-3179-77; AF Proj. 2304)
(AD-A078826; ORC-79-6) Avail: NTIS HC A03/MF A01 CSCL 12/2

This is the first part of a study of stochastic processes generated by failures and repairs of components in a series system. Selected asymptotic measures of system performance are calculated for a two component series system where failure of component 1 shuts off component 2 but not vice versa. Intuitively, it is best to shut off an operating component when the system is down. However, this is not correct if the component failure distribution is IFR (or more generally NBUE) and we wish to maximize the long run average of system uptimes. Part 2 uses the method of supplementary variables to obtain explicit results for important special cases. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-18873 Colorado Univ. at Boulder.

MULTIPLIER REPRESENTATIONS OF THE TWO-DIMENSIONAL LATTICE GROUP Ph.D. Thesis

Wesley Edward Mitchell 1979 85 p
Avail: Univ. Microfilms Order No. 8003002

There exist multipliers on the two-dimensional lattice group such that the multiplier dual is not smooth. Thus, classical methods will not suffice for the description of the multiplier dual. A set of generalized tensor product representations is constructed, beginning with irreducible multiplier representations induced from some normal subgroup. A complete decomposition theory is given for this set. Because of a relationship between certain of these generalized tensor products and multiplier regular representations, direct integral decompositions of multiplier regular representations are found. Furthermore, there are infinitely many mutually disjoint decompositions. The integrands have the property that, for a certain fixed subgroup N and any positive integer n, there is a decomposition satisfying: the restriction of each integrand to N is equivalent to a direct sum of n copies of the regular representation of the integers. Dissert. Abstr.

N80-18874 Oklahoma Univ., Norman.

CLASSIFICATION OF THE NORMAL SUBGROUPS OF GI SUB N (R) Ph.D. Thesis

Jeanna Beth Moore 1979 50 p

Avail: Univ. Microfilms Order No. 8004393

It is shown that for any ring R (not necessarily commutative) the solvability of certain systems of equations is sufficient to show that normal subgroups of GL sub n (R) are also sandwiched between two normal subgroups of the group of elementary transvections. The system of equations whose solvability is necessary are those whose coefficient matrix is obtained from an invertible matrix by deleting the ith row and jth column i and j and whose constant terms are all zero except for the first which is the element of the jth row and ith column of the inverse of the matrix. Various rings in which these systems are solvable are discussed. For example, these systems are shown to be solvable in division rings by use of Ore determinants. Other rings discussed are the ring of cross sections of a sheaf over a Boolean space and both products and direct limits of rings in which the systems are solvable. Dissert. Abstr.

N80-18876 Colorado Univ. at Boulder.

GENERALIZED INVERSES OF MATRICES OVER LOCAL RINGS Ph.D. Thesis

Jerry Dale Hopponen 1979 85 p
Avail: Univ. Microfilms Order No. 8002984

A theory of generalized inverses of rectangular matrices over an arbitrary local ring is presented, and related combinatorial results derived. The concept of a generalized inverse is used to discuss solutions of the matrix equation Ax = b. For fixed matrices A and B having the same rank over an arbitrary field, linear algebraic results are derived for relations between the null and range spaces of A and B. As a special case, some results are stated when the ground field is formally real, and additional relations are determined when B = A(T). A canonical form is developed for matrices over a local ring in which the maximal ideal is principal and the descending chain condition holds. Over such rings, it is shown that the conditions which are usually taken to define the various types of generalized inverses for a matrix A cannot begin to be satisfied unless A has a special canonical form. Dissert. Abstr.

N80-18877# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.

STABILITY AND FIXED POINTS OF POINT DISSIPATIVE SYSTEMS Interim Report

Paul Massatt Jun. 1979 30 p refs
(Grant AF-AFOSR-3092-76; AF Proj. 2304)
(AD-A077410; AFOSR-79-1167TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The result requires the stronger assumption of compact dissipative. The principle result of this paper will be to get similar results under the weaker assumption of point dissipative. Need exists to add additional hypotheses on the space and the operator T. These hypotheses are naturally satisfied for stable neutral functional differential equations and retarded functional differential equations of infinite delay. The paper will be divided into four sections. The first will contain various definitions. The second will contain an abstract theorem relating point dissipative in one space to bounded dissipative in another, and to the existence of a fixed point. The third section will apply the result to stable neutral functional differential equations. The final section gives applications to retarded functional differential equations with infinite delay. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-18877# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MAGNETIC PROPERTIES OF AMORPHOUS HEISENBERG FERROMAGNET WITH RANDOM ANISOTROPY

R. Kishore, I. C. da Cunha Lima, and M. Cristina Forti Dec. 1979 15 p refs Revised Submitted for publication
(INPR-1641-RPE/097-Rev) Avail: NTIS HC A02/MF A01

Magnetization, susceptibility, and the critical temperature for a spin one amorphous Heisenberg ferromagnet with random local anisotropy are calculated in molecular field approximation for the exchange interaction. The effects of random fluctuations of the magnitude of the local anisotropy about its crystalline value are studied for various probability distributions. It is found that for a given randomness, measured in terms of the root mean square fluctuation of the magnitude of the local anisotropy, the magnetization and the critical temperature depend more on the range, defined as the magnitude of the maximum value of the fluctuation from its mean value, than the shape of the probability distribution function. The effect of randomness decreases as the crystalline value of the anisotropy increases. Calculation of the susceptibility shows that above the critical temperature, randomness has no effect. Author

N80-18878# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

NOTES ON THE COORDINATE SYSTEMS AND TIME

Luiz Danilo D. Ferreira, Wilson Custodio C. DaSilva, and Hans U. Pilchowski Dec. 1979 56 p refs In PORTUGUESE; ENGLISH summary Presented at the Seminar. de Dinamica Orbital
(INPE-1634-RPE/093) Avail: NTIS HC A04/MF A01

The celestial coordinate systems used in astronomy to define the position of objects on the celestial sphere are examined. The transformations of a coordinate system into others and the relationship between astronomic and atomic times is discussed. A.W.M.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-18879 Rensselaer Polytechnic Inst., Troy, N. Y.

ANALYSIS OF ACOUSTIC VARIATIONS IN THE OCEAN PRODUCED BY COMBINED ENVIRONMENTAL EFFECTS Ph.D. Thesis

Kenneth George Hamilton 1979 165 p
Avail: Univ. Microfilms Order No. 8004759

Mathematical models of sound propagation in the ocean are formulated using ray theory. Variations in the ocean environment, such as currents, horizontal and vertical sound-speed changes, and bottom topography, are examined separately and in combination to ascertain their effects on acoustic amplitude and phase. Simplified approximations are derived in order to predict these effects. The effects of a combination of sound-speed and current fluctuations on propagation of a continuous wave (CW) signal in a deep ocean model are analyzed. The influence of sound-speed fluctuations on propagation of a CW signal in an ocean with a uniformly sloping bottom and a horizontal surface is analyzed using ray theory. A simplified approach is described for determination of phase perturbations produced by variations in sound speed and current in the ocean. The method is demonstrated for both shallow and deep ocean examples, when the phase perturbation arises from weak horizontal deviations from a horizontally uniform sound-speed structure. It is also illustrated for currents in the deep ocean, considering cases with and without horizontal variations in current speed. Dissert. Abstr.

N80-18880 New Orleans Univ., La.

MULTI-OBSTACLE ACOUSTIC SCATTERING Ph.D. Thesis

Lawrence Lamar Sorensen 1979 88 p
Avail: Univ. Microfilms Order No. 8004386

The simple source formulation was extended to the case of scattering of acoustic waves in two dimensions by several obstacles. The method consists of representing the velocity potential as the integral of an unknown source density times an appropriate Green's function, the integral to be taken over the contours enclosing the two dimensional scatterers. A computer program was used to implement this method and calculate the source density and farfield scattering amplitude. Cases which previously defied verification were checked using the reciprocity principle or the optical throrem. The former states that the interchange of source and observation points, both infinitely far removed from the scatterer, leaves the source density unaltered. The optical theorem, which relates the total scattering cross section to the real part of the forward scattering amplitude, provides a non-linear check on the scattering amplitude. Sample problems considered include two circular cylinders, two elliptical cylinders and a circular cylinder above an infinite flat plat. Plots of farfield scattering amplitude and verification data are included. Dissert. Abstr.

N80-18881 Georgetown Univ., Washington, D.C.
INFLUENCE OF ABSORPTION ON ULTRASONIC NON-SPECULAR REFLECTIVITY Ph.D. Thesis
Tran Dai Kiem Ngoc 1979 82 p
Avail: Univ. Microfilms Order No. 8004699

A theoretical and experimental investigation of nonspecular ultrasonic reflectivity at a liquid-solid interface is described. The role of attenuation in the formulation of the plane wave reflection coefficient is analyzed. This attenuation-dependent reflection coefficient is used in a numerical integration method which is developed for the calculation of the reflected beam profile. The reflected profile is calculated for two specific cases: incidence near the Rayleigh angle for a water-stainless steel interface and incidence near the longitudinal critical angle for a water-Plexiglas interface. In each case, the nonspecular reflection effects are investigated as one parameter is varied and the others are kept unchanged. Comparisons are made with results obtained by the Bertoni and Tamir formulation for incidence at the Rayleigh angle. The theoretical predictions are then compared to experimental results obtained by the Schlieren visualization technique. Dissert. Abstr.

N80-18882*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF COHERENCE IN FAN NOISE STUDIES
Joseph R. Balombin Feb. 1980 26 p refs
(NASA-TP-1630; E-157) Avail: NTIS HC A03/MF A01 CSCL 20A

A study of fan noise was made by using the coherence function to obtain far field spectra that were coherent with the fan rotational rate. Choosing fan rotational rate as one of the two variables yielded new information about the far field noise generated during static fan testing. As a result of this coherent data processing, the inlet fan-tone noise present in static testing was determined to be mostly random when the rotor-alone and rotor-stator interaction tones were cut off. After the rotor-alone sound field was cut on, the sound pressure became coherent, and the angular extent of high coherence increased as fan speed was increased. In addition, the sound field was organized as a pattern of lobes whose amplitude varied slowly with time. Additional fan test results indicate that operating the fan with an inflow control device can partially reduce the fan-tone noise levels to those produced by coherent processing. R.E.S.

N80-18883# Royal Aircraft Establishment, Farnborough (England).
THE RESPONSE OF AN ELECTROSTATIC MICROPHONE TO AN AIRFLOW
R. Gamba Jun. 1979 30 p refs Transl. into English from Rev. d'Acoustique (France), v. 40, 1977 p 46-57
(RAE-Lib-Trans-2011; BR71912) Avail: NTIS HC A03/MF A01

The origins of the different pressure fluctuations picked up by a microphone in an air stream are discussed. The behavior of a condenser microphone when the direction of the airflow is perpendicular to the diaphragm is theoretically studied. Finally an experimental study is conducted during which the following parameters are varied: the average wind velocity (5-20 m/s); the percentage of turbulence (0.01-1%); and the diameter of microphone (1 inch, 1/2 inch, 1/4 inch). The output levels induced by turbulence and by a laminar quiet airflow are examined. The effect of the standard protection grill or ogive is studied in each case. M.G.

N80-18884*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PUBLICATIONS IN ACOUSTIC AND NOISE CONTROL FROM NASA LANGLEY RESEARCH CENTER DURING 1940-1979
Barbara A. Fryer, comp. Jan. 1980 104 p refs Update
(NASA-TM-80211) Avail: NTIS HC A06/MF A01 CSCL 20A

Reference lists of approximately 900 published Langley Research Center reports in various areas of acoustics and noise control for the period 1940-1979 are presented. Specific topic areas covered include: duct acoustics; propagation and operations; rotating blade noise; jet noise; sonic boom; flow surface interaction noise; structural response/interior noise; human response; and noise prediction. J.M.S.

N80-18885# Battelle Columbus Labs., Durham, N. C.
ATMOSPHERIC EFFECTS ON THE SPEED OF SOUND
E. A. Dean Aug. 1979 60 p refs Prepared in cooperation with Texas Univ. at El Paso
(Contract DAAG29-76-D-0100; DA Proj. 1L1-62111-AH-71)
(AD-A076060; ERADCOM/ASL-CR-79-0100-4) Avail: NTIS HC A04/MF A01 CSCL 20/1

The small-signal speed of sound in humid air is calculated from a model which includes the real-gas effects from the equation of state for humid air and the vibrational dispersion due to N2, O2, and CO2 relaxation. Other atmospheric effects such as dispersion due to viscothermal and rotational relaxation, heat radiation, propagation along the air-ground boundary, the density gradient, turbulence, aerosols and fogs are considered and found to be unimportant for frequencies between 1 Hz and 5 MHz (at one atmosphere). The uncertainty in predicting the sound speed varies between 0.22 m/sec at -90 C to 0.05 m/sec at 90 C. Experimental results in humid air at 20 C and 30 C are in excellent agreement with the model. For the propagation frequency of 20 Hz, it is found that the presently used sound-ranging formula, c = 20.06 x square root of T sub s, where T sub s = .75t sub v - .25t - 273.2 (t sub v = virtual temperature), differs by up to 0.5 m/sec over the range -60 C to 60 C. A correction to the 'sonic' temperature determination is suggested which results in deviations of less than 0.05 m/sec over the temperature range from -60 C to 50 C and for relative humidities from 5% to 100%. GRA

N80-18886# Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
THE GENERATION OF A TOLLMIEN-SCHLICHTING WAVE BY A SOUND WAVE
John W. Murdock Aug. 1979 22 p refs
(Contract N00014-78-C-0491)
(AD-A075816; ATR-79(7775)-1) Avail: NTIS HC A02/MF A01 CSCL 20/1

A spectral numerical method is used to study the two-dimensional unsteady flow over a flat plate in the presence of a plane sound wave propagating parallel to the flow. For s = omega x/u at infinity = 0(1), no observable interaction or energy interchange between the sound wave and the Tollmien-Schlichting wave is present. In the region (s - or < = 0) edge, an interaction occurs; the magnitude of this interaction is computed. A plane sound wave with dimensionless frequency omega nu/U-square at infinity = .000056 generates a Tollmien-Schlichting wave of the same frequency and an amplitude at the first neutral point .0001 times the sound-wave amplitude. Computations at a second, lower frequency result in a lower neutral point amplitude. The response of the boundary layer to large unsteady disturbances is discussed and compared with published behavior based on the boundary layer equations. Solutions of the Orr-Sommerfeld equation are examined and found to have a different character for s = or > 0(1) consistent with the more complete equations. GRA

N80-18887# Pennsylvania State Univ., University Park. Applied Research Lab.
TRANSIENT ACOUSTIC RADIATION FROM ELASTIC PLATES Ph.D. Thesis
Seroj Mackertich Sengerdy Apr. 1979 112 p refs
(Contract N00024-79-C-6043)
(AD-A076772; ARL/PSU-TM-79-50) Avail: NTIS HC A06/MF A01 CSCL 20/1

An expression for the acoustic radiated pressure emanating from an infinite elastic plate excited by a unit impulse load for different observation angles and distances is obtained analytically. The solution is obtained by use of Fourier transform on time and Hankel transform on the radial coordinate. Using Cauchy contour integration theorem and regular and modified saddle-point methods, the inverse Fourier and Hankel transforms were evaluated. The unit impulse response and convolution theorem was then utilized to obtain an expression for radiated pressure of an infinite elastic plate excited by constant magnitude load, square pulse and CW-pulse loads. The first arrival of acoustic wave at an observer point in the acoustic medium due to an impulse load was shown to correspond to the time of travel for the normal distance from the observer to the plate. After the first arrival, the acoustic pressure was shown to decay sinusoidally with an increasing period of oscillation. The decay rate for long times was shown to be the reciprocal of elapsed time. Similar response was shown for a square pulse and for a CW-pulse after the removal of the load. Author (GRA)

N80-18888# Naval Research Lab., Washington, D. C. Transducer Branch.

ACOUSTICAL BEHAVIOR OF THICK, COMPOSITE, FLUID-LOADED PLATES, CALCULATED USING TIMOSHENKO-MINDLIN PLATE THEORY Interim Report

Anthony J. Rudgers 16 Nov. 1979 27 p refs
(RR0110842)
(AD-A077671; NRL-8317) Avail: NTIS HC A03/MF A01
CSCL 20/1

The reflected and radiated acoustic fields of a thick, composite plate of infinite extent, consisting of a substrate layer bonded at an interface to a coating layer, which has fluid on one side and which is unconstrained on the other side, are calculated theoretically. The reflected and radiated acoustic fields are related by means of a structural response function that completely characterizes the elastic behavior of the composite plate and of the fluid. The composite-plate acoustical problem is analyzed by extending the Timoshenko-Mindlin theory of thick homogeneous plates. The Timoshenko-Mindlin thick-plate equations are used to describe the flexural waves generated in each of the two layers of the composite plate, owing either to a plane acoustic wave in the fluid impinging on the plate or to a point-force excitation of the plate. Two ideal types of bonding between the coating and the substrate are considered: the 'welded' bond, for which contiguous plate elements on either side of the interface move in complete unison, and the 'perfectly slipping' bond, for which such plate elements move in unison normal to the interface but independently parallel to the interface. The analytic form of the structural response function of a composite plate shows that in general a thick bilaminar composite plate of the type considered cannot be modeled by a simple homogeneous thick plate with artificial or 'average' material constants. The analysis also shows that the bond between the substrate and the coating significantly affects the acoustic reflection and radiation characteristics of the composite plate. GRA

N80-18889# Yale Univ., New Haven, Conn. Dept. of Systems and Information Sciences.

SURFACE SCATTERING STUDIES Final Report, Apr. 1978 - Jun. 1979

J. G. Zorning, P. M. Schultheiss, J. Snyder, S. Singhal, and D. C. Gilbert Aug. 1979 99 p refs
(Contract N00014-75-C-1014)
(AD-A078434; S/IS-7905) Avail: NTIS HC A05/MF A01
CSCL 20/1

Progress in a number of ongoing projects is reported. These include studies of bistatic and monostatic surface scattering strength, surface reverberation modelling, measurement of slope and correlation statistics of surfaces, and measurement of Doppler shifts and spread. The extension of previous scattering strength measurements to lower frequencies has shown the strengths observed to be 10 to 15 dB higher under similar wind conditions but with wavelengths approximately 8 times longer. These studies have led to the beginning of development of a model for reverberation based on a characterization of the surface as an ensemble of facets. A method for precision measurement of model tank waveheight and wave slope time series has been developed. The system is based on fine wire capacitance probes. It has been used to compile a set of slope measurements which is consistent with data reported by other investigators. A system for automatic measurement of time-space waveheight correlation has been developed. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-18890 California Univ., Irvine.

COLLECTIVE ION ACCELERATION CONTROLLED BY A GAS GRADIENT Ph.D. Thesis

Frederick Michael Mako, Jr. 1979 208 p
Avail: Univ. Microfilms Order No. 8002314

Several schemes were studied for attaining collective ion acceleration by the injection of an intense relativistic electron beam along magnetic field lines into a low pressure (less than 1 Torr of helium) neutral gas. Positive, zero, and negative gas pressure gradient schemes were examined. The case where the gas pressure decreases from the beam injection plane (the negative gradient scheme) is discussed. A simple collective ion acceleration model is presented. The model is modified to account for the electron energy distribution under the conditions where the ion energy is a maximum. A particle code was developed to enable a study of the complete, self consistent, initial condition problem. Dissert. Abstr.

N80-18891 Colorado Univ. at Boulder.

COLLISIONAL REDISTRIBUTION OF LIGHT SCATTERED BY ATOMIC VAPORS Ph.D. Thesis

Michael Gordon Raymer 1979 183 p
Avail: Univ. Microfilms Order No. 8003008

The effects of atomic collisions on the scattering of laser light by atomic vapors was examined. At high laser intensities, the light scattering was found to become stimulated, and was spectrally resolved into two components: stimulated Raman scattering (SRS) and stimulated collision induced fluroescence (SCF). A theory was developed to describe the behavior of SRS and SCF when the incident laser was of the pulsed type. The experimental results, including pressure dependence, focusing dependence, and directional dependence of the SRS and SCF, were found to be in agreement with the theory presented.
Dissert. Abstr.

N80-18892 Missouri Univ. -Rolla.

NEGATIVE ION CHARGE TRANSFER OF THE REACTION OF S- AND O- WITH ATOMIC HYDROGEN PRODUCING H- IONS FROM 1500 TO 10 KEV Ph.D. Thesis

George Frederick Hagner 1979 88 p
Avail: Univ. Microfilms Order No. 8002322

The charge transfer reactions of O(-), S(-) with atomic hydrogen were studied from 1.5 to 10 KeV, and the reaction Cl(-) + O2 - O2(-) + Cl was studied from 10 eV to 10 KeV. The results are compared to a modified theoretical treatment for positive ions. A crossed beam technique was used to perform the measurements. The ion beam was produced by a conventional hot anode arc discharge. The neutral beam was produced by a joule heated tungsten oven. Counting techniques were used in the data collection. Dissert. Abstr.

N80-18893 Connecticut Univ., Storrs.

ROTATIONAL-VIBRATIONAL EXCITATION IN COLLISIONS OF ATOMIC IONS WITH DIATOMIC MOLECULES Ph.D. Thesis

James Donald Clark, Jr. 1979 238 p
Avail: Univ. Microfilms Order No. 8003743

Rotational vibrational excitation in atomic ion-diatomic molecule collisions are considered at intermediate ion projectile energies in the range of 1 - 3 keV. Collisions between He(+) and H2 are taken as an example. Three separate approaches are used in the description of the collision system. Inelastic energy transfer in collision systems and projectile scattering angle are calculated from a totally classical approach. Cross sections for scattering as a function of momentum transfer vector are calculated from a completely quantum mechanical approach. Molecular transitions from the ground rotational vibrational state to several excited rotational vibrational molecular states are considered. Dissert. Abstr.

N80-18894 Pittsburgh Univ., Pa.

DRIFT TUBE STUDIES OF ION-MOLECULE REACTIONS AT

HIGH AND LOW TEMPERATURES Ph.D. Thesis

Aikwo Chen 1979 135 p
Avail: Univ. Microfilms Order No. 8004855

A temperature variable drift tube mass spectrometer apparatus has been used to determine the rate coefficients for the charge- and atom-transfer reactions O(+)N2 and O(+)+O2 (from 300K to 900K), He(+)+H2 and He+D2 (from 78 to 300K), as well as the association reactions R + 2R, where R is He, Ne or Ar (from 78K TO 300K). For the atom transfer reaction O(+)+N2, the rate coefficient decreases from (1.2 + or - 0.1) x 10 to the minus 12th power cu cm/sec to 0.5/10 to the minus 12th power cu cm/sec as the temperature is increased from 300K to 900K. For the charge transfer reaction O(+)+O2, the rate coefficient decreases from (2.1 + or - 0.2)x 10 to the minus 11th power cu cm/sec at 300K to half this value as the temperature is raised to 700K. These results are in good agreement with heated flowing afterglow results.
Dissert. Abstr.

N80-18895 Oklahoma Univ., Norman.

COVARIANT ELECTRODYNAMICS IN A MEDIUM Ph.D. Thesis

Nak Hyung Hong 1979 59 p
Avail: Univ. Microfilms Order No. 8004389

The energy-momentum and angular momentum emission rates for an arbitrarily moving charge (whose speed is less than that of light in the medium) in a uniform transparent medium are calculated in manifestly covariant form. The calculations are executed for three types of stress tensors: Minkowski, Abraham, and Marx. It is found that the energy-momentum emission rates for all three tensors are found to be equal. Only for the Marx tensor is this rate independent of the orientation of the associated asymptotic space-like surface. The calculations are extended to a dyon of electric charge m. It is shown that all three tensors take the same form as those of the electric charge case except that e squared is replaced by e squared t (epsilon/mu)(m squared). It may be concluded, as far as radiation is concerned, that a magnetic monopole behaves like a charged particle of effective charge (square root of (epsilon/mu))(m). Dissert. Abstr.

N80-18896 California Univ., Davis.

STUDIES IN MOLECULAR DYNAMICS OF THE FRICTION COEFFICIENT AND THE LORENTZ GAS Ph.D. Thesis

William Edward Alley 1979 184 p
Avail: Univ. Microfilms Order No. 8003494

Various hard sphere molecular dynamics studies are presented. The first describes a modification of Fick's diffusion law, required whenever long time correlations are present. For the Lorentz gas, the non-Markovan nature of the transport process is shown to correspond to a random walk where, after each step, the particle waits for a time as sampled from a waiting time distribution before making the next move. Second, the mass and size dependence of the friction coefficient as well as its dependence on boundary conditions is discussed. A molecular dynamics method is presented which calculates the infinite-mass friction coefficient of finite size hard-sphere particles. The applicability of hydrodynamics is considered to describe fluctuations in fluids on the molecular level. It is shown that the fluctuations present in a system of hard spheres, when placed between closely spaced parallel hard walls, lead to an acoustical resonance for those wavelengths which correspond to the spacing, or integer fractions thereof. Dissert. Abstr.

N80-18897 Wisconsin Univ. - Madison.

AN INTENSE SOURCE OF NEGATIVE POLARIZED HYDROGEN IONS Ph.D. Thesis

Richard Stephen Raymond 1979 136 p
Avail: Univ. Microfilms Order No. 7928660

Experiments are described which were conducted to study the feasibility of producing an intense beam of negative polarized hydrogen ions by ionizing thermal polarized hydrogen atoms by collision with a fast beam. Results indicate that if negative hydrogen ions are used as the fast beam, the space charge electric fields associated with the ionizing beam seriously complicate formation of the negative polarized beam. Experiments have demonstrated that a beam of 45 keV neutral cesium atoms may be used to produce intense negative polarized hydrogen or deuterium beams. Negative beams with currents as high as 3.1 micro amps are produced by this method. The tensor polarization of a deuterium beam was measured to be 92% of expected value, with weak field ionization. The emittances of hydrogen and deuterium beams were measured and found to be sufficiently small for good transmission through accelerators. Prospects for an operating ion source using this method are discussed. Dissert. Abstr.

N80-18898 Cornell Univ., Ithaca, N. Y.

COMPUTER SIMULATION AND THEORETICAL STUDIES OF MOLECULAR LIQUIDS Ph.D. Thesis

Sohail Murad 1979 294 p
Avail: Univ. Microfilms Order No. 8003966

Theoretical and simulation methods are developed and applied to both real and model fluids. A method for carrying out computer simulation studies of molecular liquids, based on quaternions was used to carry out detailed molecular dynamics studies of methane, vanadium tetrachloride, and hydrogen chloride. The simulation results for the fluids are compared with the available experiments data for thermodynamic properties, structure factor, mean squared torque, and diffusion coefficients. Quantum corrections to the thermodynamic properties are worked out. In an effort to simplify the use of site-site models in current theories, the expansion of such potentials in spherical harmonics was studied. Explicit analytical expressions are obtained for molecules of general shape, and the convergence of the series is studied for linear, tetrahedral, and octahedral molecules of various bond lengths. A second order perturbation theory is presented for the pair correlation function of a molecular fluid. The theory is compared with three integral equation methods and with simulation results, for both dipolar and quadrupolar fluids. Such comparisons are given for the harmonic coefficients of the pair correlation function, the thermodynamic properties, the mean squared torque, the dielectric constant, and the Kerr constant angular correlation parameter. Dissert. Abstr.

N80-18899 Florida Univ., Gainesville.

ALTERNATIVE DECOUPLINGS OF THE ELECTRON PROPAGATOR Ph.D. Thesis

Gregory J. Born 1979 175 p
Avail: Univ. Microfilms Order No. 8002837

Several alternative decouplings of the electron propagator are investigated. Operator product decouplings are reviewed and discussed. The moment conserving decouplings which consist of Pade's approximants to the propagator moment expansion are investigated. A partitioning of the superoperator Hamiltonian is invoked, and a perturbation expansion of the superoperator resolvent is developed. Renormalized decouplings are considered, and the two particle one hole, Tamm-Dancoff approximation is specifically derived and investigated. The decoupling approximations are evaluated on the basis of computational applications in which the propagator poles are compared to experimentally determined ionization energies for several molecules.
Dissert. Abstr.

N80-18900 Texas A&M Univ., College Station.

STOPPING POWER MEASUREMENT IN THE 20-150 KeV REGION USING THICK TARGET BACK-SCATTERING: 1H AND 4He ON CARBON, SILICON AND GOLD Ph.D. Thesis

James David Pearce 1979 75 p
Avail: Univ. Microfilms Order No. 8003173

Stopping powers for 20-150 keV hydrogen and helium ions in carbon (graphite), silicon, and gold were determined using thick target backscattering in an effort to assess the applicability and/or limitations of the technique for performing absolute stopping power measurements in the intermediate and low energy regions. Present calculations (which have an estimated probable error of less than 5%) are in good agreement with other measurements performed on 'bulk' type targets, but are significantly higher than those reported from thin film measurements. Due to the scarcity of stopping power data in the low and intermediate energy regions for bulk targets, much more experimental work is required before definite conclusions can be reached concerning the discrepancies in the measured stopping powers. Dissert. Abstr.

N80-18901 Princeton Univ., N. J.
PRODUCTION OF A MOLECULAR BEAM OF LIGAND-FREE METAL CLUSTERS Ph.D. Thesis
Gregory Lee Griffin 1979 184 p
Avail: Univ. Microfilms Order No. 8003785

A multiple expansion cluster source (MECS) for producing a molecular beam of metal clusters is described. The unique advantages of the MECS are the ability to produce narrow particle size distributions and to control the mean cluster size. These features permit investigations in the areas of thin film deposition, sintering of supported metal catalysts, and aerosol separation processes. A theoretical treatment of the entropy of crystalline microclusters is described along with an apparatus to measure the photoionization potential of cluters in the beam.
Dissert. Abstr.

N80-18902 Florida Univ., Gainesville.
A MOLECULAR THERMODYNAMIC MODEL FOR AQUEOUS SOLUTIONS OF NONPOLAR COMPOUNDS AND MICELLE FORMATION Ph.D. Thesis
Robert James Brugman 1979 297 p
Avail: Univ. Microfilms Order No. 8002839

A thermodynamic process for micellization is developed which provides a basis for better understanding of molecular mechanisms important in the formation of micelles as well as other processes of aqueous solution. The foundation of a model of the micelle formation process is a unified molecular thermodynamic theory of aqueous solutions. For spherical gases, a modification of scaled particle theory is used for the excluded volume contribution while a mean field theory approach is used for intermolecular interactions. Extension of the model to aliphatic hydrocarbon solutes required development of an expression for the total interaction energy between a spherocylindrical solute and a spherical solvent. A primitive model for the thermodynamic properties of ionic micellization is tested using the aqueous solubility model and electrostatic theories. Dissert. Abstr.

N80-18903# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SPIN WAVES IN ITINERANT ELECTRON SPIN DENSITY WAVE STATES
R. Kishore Oct. 1979 19 p refs Revised Submitted for publication
(INPE-1594-RPE/080-Rev) Avail: NTIS HC A02/MF A01

The transverse dynamical susceptibility and the spin wave stiffness constant of spin density wave states in itinerant electron systems are studied. The Hamiltonian is transformed by using a transformation which rotates the spin coordinate system locally, so that the new z direction lies in the direction of the local spin. For the transformed Hamiltonian, a self consistent many body theory is exploited to derive an exact expression for the transverse dynamical susceptibility. From the long wave length limit of the spin wave spectrum, given by the poles of the transverse dynamical susceptibility, an exact formula for the spin wave stiffness constant is obtained. Within the Hartree-Fock approximation, it reduces to the Fisher's formula for antiferromagnets.
A.W.H.

N80-18904*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
INDUCED RADIOACTIVITY IN RECOVERED SKYLAB MATERIALS
G. J. Fishman and C. A. Meegan Jan. 1980 13 p refs
(NASA-TM-78263) Avail: NTIS HC A02/MF A01 CSCL 20H

Four radioactive isotopes found in aluminum and stainless steel samples from Skylab debris were recovered in Australia. The low-level activity was induced by high-energy protons and neutrons in the space environment. Measurements of the specific activities are given.
Author

N80-18905# Air Force Geophysics Lab., Hanscom AFB, Mass.
COMMUTE: A COMPUTER CODE FOR NONCOMMUTATIVE ALGEBRA
Laurence S. Rothman Jul. 1979 30 p refs
(AF Proj. 2310)
(AD-A077360; AFGL-TR-79-0152; AFGL-ERP-666) Avail: NTIS HC A03/MF A01 CSCL 07/4

A computer code has been developed that operates on angular momentum and direction cosine operator products to form a reduced set of lower degree. The program has been used extensively in obtaining the eigenvalues and eigenvectors of the Hamiltonian describing the vibration-rotation levels of triatomic asymmetric rotor molecules. Examples of the use of the program as well as a listing are documented.
GRA

N80-18906# SRI International Corp., Menlo Park, Calif.
MECHANISMS OF MULTIPHOTON DISSOCIATION OF MOLECULAR IONS Summary Report, Nov. 1978 - Nov. 1979
Michael J. Coggiola and James R. Peterson Nov. 1979 4 p
(Contract N00014-76-C-1035)
(AD-A077227) Avail: NTIS HC A02/MF A01 CSCL 07/5

This report discusses the dissociation of molecular ions resulting from infrared photon absorption by highly vibrationally excited molecular ions. Photofragments will be identified and their dissociative lifetime determined where possible. Measurements will also be made of the fragment translational energy distribution. Results to date on ions such as CF3I-, CF3Br-, and C3F6- show that a strong correlation exists between this single photon dissociation process and the final step of multiphoton dissociation. Preliminary analysis indicates that the dissociation dynamics follow a simple statistical mechanism.
GRA

N80-18907# Naval Academy, Annapolis, Md.
THE EFFECT OF ELECTROSTATIC FIELDS ON REACTING MOLECULES Final Report, 1978 - 1979
Alan B. Whiting May 1979 31 p refs
(AD-A077581; USNA-TSPR-102) Avail: NTIS HC A03/MF A01 CSCL 07/3

The work synthesizes some model compounds whose structure provides a dipole for interaction with electric fields. The Diels-Alder addition of furan to maleic anhydride and 6,6-dimethylfulvene to maleic anhydride in electric fields of 0, 240, and 350 V/cm were studied, and they were set to react in a cell in which a static electric field was maintained. It was found that the furan addition was uneffected by the fields, but that the proportion of exo to endo isomers of the 6, 6-dimethylfulvene product changed in a qualitatively predictable way. The details are described in the papers.
GRA

N80-18908# Tennessee Univ., Knoxville.
SUMMARY QUESTIONNAIRE RESPONSE 7901, OCTOBER 1979 Progress Summary Report, Nov. 1978 - Oct. 1979
I. A. Sellin Oct. 1979 14 p refs
(Contract N00014-75-C-0474)
(AD-A075951; Rept-7901) Avail: NTIS HC A02/MF A01 CSCL 20/8

This document is an annual summary questionnaire response associated with work performed on the project entitled "Structure of Highly Ionized Heavy Ions and Associated Collision Phenomena in the MeV/nucleon Range."
GRA

N80-18909# New York Univ., N. Y. Dept. of Physics.
THEORY OF SATURATION SPECTROSCOPY INCLUDING COLLISIONAL EFFECTS
P. R. Berman, P. F. Liao, and J. E. Bjorkhom Sep. 1979 31 p refs
(Contract N00014-77-C-0553)
(AD-A075830) Avail: NTIS HC A03/MF A01 CSCL 07/4

A theory of saturation spectroscopy in three-level gas vapor systems, including collosional effects, is presented. Using a model of collisions in which they are phase-interrupting in their effect on level coherences and velocity-changing in their effect on level population densities, we calculate the absorption profile of a weak probe field on a given transition when an arbitrarily strong pump field acts on a coupled transition. Line shapes are derived for an arbitrary collision kernel describing the velocity-changing collisions, and these line shapes are evaluated for the collision kernel proposed by Keilson and Storer. Various limiting forms for the line shapes are derived and representative line shapes are displayed. Several new features of the line shapes, including collisionally-induced increased probe absorption are discussed. The line shapes are seen to reflect the various collisonal processes that may occur in atomic or molecular systems. GRA

N80-18910# Washington Univ., Seattle. Dept. of Chemistry.

A CRUCIAL DEMONSTRATION OF STRONG COLLISION BEHAVIOR OF VIBRATIONAL ENERGY FOR GAS-SURFACE COLLISIONS

N. C. Flowers, F. C. Wolters, D. F. Kelley, and B. S. Rabinovitch 1 Dec. 1979 9 p refs
(Contract N00014-75-C-0690)
(AD-A078800; TR-14) Avail: NTIS HC A02/MF A01 CSCL 20/13

The Variable Encounter Method was applied to the study of the transient region in vibrational accommodation of reacting cyclobutene at surfaces. Collision efficiency declines with rise of temperature. Surface collisions are more efficient than binary gas phase encounters and, at temperatures below 450 K, the wall behaves like a theoretical strong collider. GRA

N80-18911# Naval Academy, Annapolis, Md.

THE KINETICS OF ION MOTION IN CaF2:Er Final Report, 1978-1979

8 Jun. 1979 64 p refs
(AD-A077555; USNA-TSPR-97) Avail: NTIS HC A04/MF A01 CSCL 20/6

Optical density versus wavelength was measured for CaF2:Er(3+) crystals as a function of the temperature to which the crystals were heated prior to quenching. The quenching of the crystals had the effect of freezing in the high temperature equilibrium defect configurations in the crystal. The results obtained support assignments of the optical absorption lines to various defect configurations. It was observed that the absorption line at 537.43 nm increased in height by a factor of about 20 as a result of heating and quenching, supporting the assumption that it is the result of a monomer defect site. The behavior of the absorption lines at 537.06 nm and 537.92 nm support the models that these lines are due to low order clusters. The equilibrium among the defects of the CaF2:Er crystals can be described by an Arrhenius process characterized by an activation energy of 1.26 + or - 0.02 eV. The equilibrium, characteristic of the temperature from which the crystal was quenched, has been modeled to be established by mobile interstitial fluorines. GRA

N80-18912# Columbia Univ., New York.

THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS Final Report, 1 Mar. 1974 - 28 Feb. 1979

W. Happer Aug. 1979 15 p refs
(Grant AF-AFOSR-2685-74)
(AD-A078589; AFOSR-78-1308TR) Avail: NTIS HC A02/MF A01 CSCL 20/10

The overall objective of the work supported by the Air Force Office of Scientific Research grant has been to explore the basic physical properties of spin polarized atomic vapors. These systems are of considerable interest to the civilian and military sectors of our society because they can be used to make very precise measurements of time, absolute rotation rates, and electromagnetic fields. For example, the U.S. time standard is the atomic cesium hyperfine frequency; very precise atomic frequency standards are used in satellites and on Earth for a wide variety of uses. Optically pumped magnetometers are used by the oil and mining industry for prospecting, by archaeologists for locating lost cities and sunken treasure ships, and by the navy for location of submarines. Optically pumped systems are currently being developed for use as gyroscopes which may have real advantages in terms of ruggedness and economy. In spite of the widespread practical utility of these systems, there is only limited research going on the related areas. There are no more than a dozen active research groups world wide and most are in foreign countries, including several excellent laboratories in the Soviet bloc. The goal of this work has been to maintain a center of excellence for the study of spin polarized atomic vapors, to ensure that outstanding students are introduced to the field from time to time and to coordinate our research activities with the needs of industrial and government laboratories for critical information and the needs of the university for high-quality basic research. GRA

N80-18913*# Colorado State Univ., Fort Collins. Dept. of Physics.

BROAD BEAM ION SOURCE OPERATION WITH FOUR COMMON GASES

Sung-Jae Pak and James R. Sites Sep. 1979 21 p
(Contract N00014-76-C-0976; Grant NsG-3167; RR0210203)
(NASA-CR-162801; AD-A077561; SF24; SF-24) Avail: NTIS HC A02/MF A01 CSCL 20/8

A Kaufman-type broad beam ion source, used for sputtering and etching purposes, has been operated with Ar, Kr,O2 and N2 gas inputs over a wide range of beam energies (200-1200 eV) and gas flow rates (1-10 sccm). The maximum ion beam current density for each gas saturates at about 2.5 mA/sq. cm. as gas flow is increased. The discharge threshold voltage necessary to produce a beam and the beam efficiency (beam current/molecular current), however, varied considerably. Kr had the lowest threshold and highest efficiency, Ar next, then N2 and O2. The ion beam current varied only weakly with beam energy for low gas flow rates, but showed a factor of two increase when the gas flow was higher. GRA

N80-18914# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

LONG DURATION EXPOSURE EMULSION PACKAGE (LDEEP) Interim Report

R. C. Filz 19 Jul. 1979 15 p
(AF Proj. 2311)
(AD-A077362; AFGL-TR-79-0156; IP-277) Avail: NTIS HC A02/MF A01 CSCL 20/8

An exposure package has been designed to obtain measurements of trapped proton fluxes utilizing the NASA Long Duration Exposure Facility. The techniques are similar to those used in the 1960's to obtain trapped proton fluxes from Air Force recoverable satellites. The main novelty consists in the development of proton sensitive plastic detectors capable of withstanding the six month exposure planned for LDEF. At the planned LDEF altitude of 450 km, unshielded nuclear emulsion would become grossly over-exposed in six months. Early designs for LDEEP consisted of shielded emulsons with narrow cylindrical openings to allow trapped protons to enter. The discovery of the CR39 plastic detector by Cartwright et al opens up a new solution to this problem. The potential for obtaining the first reliable measurements of inner zone trapped protons of 1 to 10 Mev energy is discussed. Earlier electronic counter measurements are quite uncertain, and the NERV emulsion results covered are far too brief a time interval and were spatially limited. GRA

N80-18915# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

EXPERIMENTAL AND THEORETICAL DETERMINATION OF THE VELOCITY DEPENDANCE OF THE SCATTERING CROSS SECTIONS IN MONOMER-DIMER NOBLE GAS COLLISIONS Ph.D. Thesis - Goettingen Univ., West Germany [EXPERIMENTELLE UND THEORETISCHE BESTIMMUNG DER GESCHWINDIGKEITSABHAENGIGKEIT DES TOTALEN STREUQUERSCHNITTES BEI EDELGASATON-EDELGASDIMER STOESSEN]

Michael Dueker Sep. 1978 56 p refs In GERMAN
(MPIS-19/1978) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Goettingen, West Germany DM 10,95

The total and integral scattering cross sections of noble gases were measured, using in the primary beam Ar, Kr, and Ne atoms, and for the secondary beam the dimers Ar2, Kr2, and Ne2. The cross section ratio obtained for each dimer referred to the monomers was compared with theoretically calculated values. The potential used for calculating the dimer scattering cross section was obtained by the sum of two known potentials, introducing some simplifying hypotheses. Charts are presented showing good agreement between experimental and calculated results. Author (ESA)

N80-18916# Research Inst. of National Defence, Stockholm (Sweden).

KVAST: A COMPUTER PROGRAM TO CALCULATE THE PROTECTION OFFERED BY BUILDINGS TO FALL-OUT RADIATION [KVAST - ETT DATORPROGRAM FOER BERAAKING AV BYGGNADERS SKYDDSFAKTORER FOER KVARVARANDE STRAALING]

Eva Elvers, Majorie Nilsson, and Goeran Danielson Aug. 1979 45 p refs In SWEDISH
(FOA-C-20321-A2) Avail: NTIS HC A03/MF A01

An interactive computer program was prepared to predict the protection factors against radioactivity. The protection factor is defined as the ratio between the radiation dose inside the building and the radiation dose outside the building. The calculation methods are described, and a user manual for the KVAST program is presented. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see 93 *Space Radiation*.

N80-18917 *Massachusetts Univ., Amherst.*
PION SCATTERING FROM THE MASS THREE SYSTEM Ph.D. Thesis
Jose Pablo Mestre 1979 116 p
Avail: Univ. Microfilms Order No. 8004964

Realistic nuclear form factors were used to compute elastic and charge exchange pion scattering angular distributions from He-3 in the Glauber multiple scattering formalism. The resulting angular distributions were compared with those using the Schiff model wave function. Although both nuclear structure descriptions gave equivalent scattering shapes in the forward direction, using realistic nuclear form factors resulted in better agreement with experiment for backward angles. Two different pion nucleon approximations were studied. The first, a Gaussian pi-N parametrization, exhibited too strong a fall-off after 60 degrees, thereby deviating drastically from the experimental picture in the backward hemisphere. The second, a parametrization which included S and P partial waves, gave a much better description of the scattering. Dissert. Abstr.

N80-18918 *Texas A&M Univ., College Station.*
FIELD THEORETIC MODEL OF LOW-ENERGY PION-NUCLEON ELASTIC SCATTERING Ph.D. Thesis
Robert John McLeod 1979 104 p
Avail: Univ. Microfilms Order No. 8003165

A relativistic model of pion-nucleon elastic scattering is derived by assuming pseudoscalar coupling and suppressing the contribution of the intermediate antinucleon states. This model is suggested as a relativistic extension of the Chew-Low model, which contains no antinucleons. The antinucleons in the pseudoscalar coupling were considered to give only a small contribution in the P waves, while being responsible for a large S wave phase shift not observed experimentally. Starting with the transition matrix for the lowest order Feynman graphs of the pseudoscalar coupling, the propagator for the intermediate nucleons is decomposed and the antinucleons separated. The transition matrix is then decomposed into its isospin and angular momentum channels. These Born termpartial wave helicity amplitudes are used as driving terms of a partial wave N over D method. Crossing is included in the infinite mass limit only. The results for crossing and the noncrossing approximation are examined. Dissert. Abstr.

N80-18919 *Illinois Univ. at Urbana-Champaign.*
A NODAL GREENS FUNCTION METHOD FOR MULTI-DIMENSIONAL NEUTRON DIFFUSION CALCULATIONS Ph.D. Thesis
Richard Douglas Lawrence 1979 195 p
Avail: Univ. Microfilms Order No. 8004214

Green's functions for one-dimensional in-group diffusion-removal operators are used to generate a coupled set of one-dimensional integral equations defined over a subdomain or node. In order to efficiently accommodate changes in the cross sections due to thermalhydraulic feedback, the formalism is developed in terms of Green's functions calculated using reference values for the cross sections. The nodes are coupled by requiring continuity of the partial currents across the nodal interfaces. The integral equations are approximated using a weighted residual procedure applied within each node. The resulting matrix equations, when solved in conjunction with the linear form of the nodal balance equation, provide the necessary additional relationships between the interface partial currents and the flux within the node. The nodal method is applied to several light water reactor benchmark problems and to a four-group LMFBR problem. Dissert. Abstr.

N80-18920# North Carolina State Univ., Raleigh. Dept. of Physics.
INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS Final Report, 1 Jul. 1976 - 30 Apr. 1979
Wesley O. Doggett 30 Apr. 1979 50 p refs
(Contract F49620-76-C-0007; AF Proj. 2301)
(AD-A078515; AFOSR-79-1310TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

During this period research was performed at North Carolina State on collective ion acceleration in a vacuum diode geometry and in collaboration with a group from the Naval Research Lab on collective ion acceleration within an evacuated dielectric tube. Diode voltage and current wave forms along with transmitted beam energy and current were measured for a series of linear diameters and lengths. Beam energy loss was linear at the rate of approximately 12 j/cm. For the 8.3 and 15.9 cm length tubes, the Alfen limiting current was exceeded, indicating the creator of enough plasma for some current neutralization. Below the Alfen limit the current propagates in a pinched beam. The beam from velocity was 1.4 cm/nsec. Equipment for experimental work on electron beam propagation in evacuated magnetized pipes has been assembled and a theoretical study was made of intense electron beam equilibrium in magnetized pipes using a relativistic cold fluid model. GRA

N80-18921# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
[RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS, 1977] Annual Report
1978 98 p refs
Avail: NTIS HC A05/MF A01

Instrumentation is described for experiments in high energy physics, pion muon research, and in 100 MeV chemistry. The MEA accelerator along with its digital and analog electronics is included. Research projects include electron scattering experiments, pion and muon physics as well as the extension of particle theory. Radio and nuclear chemistry, nuclear spectroscopy, and nuclear reactions are subjects of investigation as well. Author (ESA)

N80-18922# Instituut voor Kernphysisch Onderzoek, Amsterdam *(Netherlands).*
[RESEARCH ACTIVITIES IN HIGH ENERGY PHYSICS, 1978] Annual Report
1978 109 p refs
Avail: NTIS HC A06/MF A01

Instrumentation is described for experiments in electron scattering, pion and muon physics, and in radio and nuclear chemistry. The operation of the MEA accelerator and its experimental facility is also reported. Research projects include the realization of a superconducting muon channel, nuclear muon capture, pion scattering, and the extension of particle theory. Radio and nuclear chemistry, including possible medical applications, are subjects of investigation as well. Author (ESA)

74 OPTICS

Includes light phenomena.

N80-18923 Arizona Univ., Tucson.
DESIGN AND PERFORMANCE OF AN EXPERIMENTAL DUAL-FREQUENCY DOPPLER LIDAR FOR REMOTE MEASUREMENT OF WIND VELOCITY Ph.D. Thesis
Wynn Lowell Eberhard 1979 216 p
Avail: Univ. Microfilms Order No. 8002923

An experimental Dual Frequency Doppler Lidar (DFDL) instrument, based upon an acousto-optically modulated laser, was constructed and operated. It was capable of real time wind measurement, utilizing a minicomputer for data analysis and recording. Laboratory tests, including operation in a wind tunnel with seeded flow, confirmed the predicted differential Doppler shift. The functional dependence of signal to noise ratio on equipment variables of the DFDL instrument were also verified in the wind tunnel. Outdoor wind measurements in both pure and hybrid DFDL configurations, with natural aerosols as targets, were performed. Good agreement was found between the lidar and a conventional anemometer adjacent to the sensed volume. Dissert. Abstr.

N80-18924# SRI International Corp., Menlo Park, Calif.
LIDAR OBSERVATIONS AT 0.7-MICROMETERS AND 10.6-MICROMETERS WAVELENGTHS DURING DUSTY INFRARED TEST 1 (DIRT-1)
Jan E. VanderLaan White Sands Missile Range, N. Mexico US Army Electronics Research and Development Command. Sep. 1979 57 p refs
(Contract DAAG29-77-C-0001)
(AD-A075275; SRI-TR-3; ERADCOM/ASL-CR-79-0001-2) Avail: NTIS HC A04/MF A01 CSCL 17/5

This technical report describes lidar measurements and results using 10.6-micrometers lidar and the SRI Mark IX (0.7- micrometers) lidar systems during the Dusty Infrared Test 1 (DIRT-I). Transmission comparisons are made between the two wavelengths with artillery barrages, TNT explosions, and oil/rubber fire-generated dust and smoke clouds in a test zone midway (1 km) along the lidar path. A target at the end of the lidar path provided a reference backscatter return for the transmission measurements. Backscatter properties of the dust and smoke clouds are also discussed. Results of the DIRT-I program indicate that the broad particle size distribution present in the dust generated produced little if any wavelength dependent transmission effects. The few observed exceptions where greater 10.6-micrometers transmission is indicated generally can be explained by the presence of wavelength-dependent smoke along the optical path, which is also generated by the detonations. Backscatter-to-transmission relationships are grossly related but, in general, are quite nonlinear, as can be expected when multiple and specular scatter by the large particles, as well as strong attenuations, are involved. The oil/rubber fire generated dense black smoke that was totally opaque to the 0.7 micrometers lidar, while the 10.6 micrometers transmission measurements indicate a transmission of approximately 6%. GRA

N80-18925# ITT Electro-Optical Products Div., Roanoke, Va.
BIDIRECTIONAL COUPLER FOR FULL DUPLEX TRANSMISSION ON A SINGLE FIBER Final Report, 1 May 1977 - 15 May 1979
A. R. Nelson, G. A. Gasparian, and G. W. Bickel Aug. 1979 190 p
(Contract DAAB07-77-C-1798; DA Proj. 1L1-62701-AH-92)
(AD-A075467; CORADCOM-77-1798-F) Avail: NTIS HC A09/MF A01 CSCL 20/6

The primary objective of this contract is the development of a bi-directional coupler for single optical fiber transmission systems and the implementation of two such couplers in a full duplex link with simulated length of up to 8 km, 20 Mb/s data rate, and 10 to the -8th power BER. The primary approach adapted for this task is the fiber dichroic coupler. Other approaches were also investigated. When used in a duplex optical data link, this three port device constitutes a wavelength selective bi-directional coupler. GRA

N80-18926# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.
DEVELOPMENT OF HIGH STRENGTH OPTICAL FIBER WAVEGUIDES USING RESIDUAL SURFACE COMPRESSION Final Report, Jan. 1977 - May 1979
R. K. Mohr, O. H. El-Bayoumi, N. Lagakos, H. Hojaji, P. Klocek, R. Ingel, D. S. Ma, J. H. Simmons, and P. B. Macedo Griffiss AFB, N.Y. RADC Oct. 1979 118 p
(Contract F19628-77-C-0084; ARPA Order 3282; AF Proj. 3282)
(AD-A078296; RADC-TR-79-252) Avail: NTIS HC A06/MF A01 CSCL 20/6

The primary objective of this project was to maximize the compressive strengthening obtained in low loss fibers made by the molecular stuffing process. The process being the doping of a porous high silica glass rod made by a phase separation and leaching process. The rod is subsequently sintered to form a solid glass prefrom from which fibers may be drawn. The ultimate goal being a fiber having greater than 100 ksi surface compression and loss less than 10 dB/km. As a major part of this effort, we have characterized the strengthening effects of compression and demonstrated that even moderate compression can be of value in many applications. Optical losses less than 10 dB/km are obtainable using molecular stuffing and we were able to produce preforms having greater than 75 ksi compression. Preforms and fibers having very high compression are difficult to produce and thus may not provide a practical method of dramatically increasing fiber strength. Surface compression on the order of 30 ksi is relatively easy to obtain, however, and compression of this magnitude can have significant effects on fatigue failure in many applications. We were able to demonstrate that fibers having surface compression showed no strength degradation when aged under load in air as long as the tensile load was less in magnitude than that of the compression. In fact, the strength of abraded samples was observed to improve with time. GRA

N80-18927# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
MeV GAMMA RADIATION OBSERVED BY A BALLOON-BORNE COMPTON TELESCOPE [GAMMA-ASTRONOMISCHE BEOBACHTUNGEN IN MEV-BEREICH MIT EINEM BALLONGETRAGENEN COMPTON-TELESKOP]
Franz Graml Jan. 1979 131 p refs In GERMAN
(MPI-PAE/Extraterr-151; ISSN-0340-8922) Avail: NTIS HC A07/MF A01

The construction of a telescope designed to take measurements from 1 to 20 MeV and identify point sources is described. During a flight in October 1977, radiation from the galactic anticenter as well as from NGC 4151, a Seyfert galaxy was examined. A determination of the cosmic ray spectra was made. Author (ESA)

N80-18928# Research Inst. of National Defence, Stockholm (Sweden).
A REVIEW OF FIBER OPTICS COMMUNICATIONS [FIBEROPTISK KOMMUNIKATION, EN OEVERSIKT]
Hans Ekblom Sep. 1979 74 p refs In SWEDISH
(FOA-C-30173-E2) Avail: NTIS HC A04/MF A01

A review of fiber optics communication is presented. The transmission capacity, the resistance to mechanical loads, and the sensitivity to environmental influences are examined. Some military applications are discussed and the trends for future development are estimated. Author (ESA)

N80-18063*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRACTICAL LIMITATIONS ON NOISELESS OPTICAL CHANNEL CAPACITY
S. A. Butman, J. Katz, and J. R. Lesh *In its* The Deep Space Network 15 Feb. 1980 p 12-14 refs (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-18929 Missouri Univ. - Columbia.
EXCITATION OF ELECTRON PLASMA WAVES Ph.D. Thesis
Behrooz Maraghechi 1979 110 p
Avail: Univ. Microfilms Order No. 8002381

The excitation of electron plasma waves by interaction of two electromagnetic waves is examined. Analysis is based on Maxwell's equations and the electron-gas moment equations. Formulas are derived for power absorption densities. Effects of static magnetic fields and inhomogeneties on absorption efficiency are studied numerically. Stimulated Raman backscattering of electromagnetic waves from electron plasma waves in magnetized plasma is investigated. Formulas are derived for the growth rate and threshold power associated with scattering from Langmuir and upper hybrid waves in a homogeneous plasma. An analysis of spatial amplification of the decay waves in an inhomogeneous plasma is presented. Dissert. Abstr.

N80-18930 Ohio State Univ., Columbus.

TIME- AND SPACE-RESOLVED SPECTROSCOPIC STUDIES OF LOW-CURRENT NANOSECOND-DURATION SPARK DISCHARGES IN 90% ARGON AND 10% HYDROGEN AT ATMOSPHERIC PRESSURE Ph.D Thesis

Larry Lee Wiese 1979 313 p
Avail: Univ. Microfilms Order No. 8001857

Time and axially space resolved spectra were obtained from low current (6.3 and 15 ampere) 250 nanosecond duration spark discharges produced in a mixture of 90% argon and 10% hydrogen at atmospheric pressure using a coaxial cable discharge system. The widths and intensities of H sub alpha, H sub beta and selected Ar 2 spectral lines were used to characterize the behavior of the plasma. The plasma electron density obtained from Stark broadening was found to be of similar magnitude and behavior to that observed in higher current spark discharges. The experimental apparatus and the techniques which were developed are described. The numerical smoothing and nonlinear least squares curve fitting techniques which were used to analyze the data are discussed. Dissert. Abstr.

N80-18931 Colorado Univ. at Boulder.

INVESTIGATION OF THE HOLLOW CATHODE DISCHARGE AT HIGH CURRENT DENSITY Ph.D. Thesis

Bruce Eugene Warner 1979 287 p
Avail: Univ. Microfilms Order No. 8003024

Plasma diagnostics and discharge modeling were performed on a hollow cathode discharge in helium, at current densities in excess of .01 A/sq cm. Typical discharge conditions are a cathode separation of 11 mm, helium pressure of 4-8 torr, tube voltage of 400-600 V, and tube current of up to 3 A d.c. Spectroscopic measurements of Stark broadening are discussed. Modeling of the electron energy distribution by solution of the Boltzmann equation is described. The effects of the non Maxwellian electron energy distribution on the helium excited state populations and ionization and recombination rates are calculated by a collisional-radiative model. A two fluid theory of electron and ion transport in the hollow cathode discharge is developed, which uniformly treats the sheath and negative glow regions and the (numerically) difficult region in between. It calculates the spatial variations of the electron density, ion density, electric field and potential, and ion flow velocity. Dissert. Abstr.

N80-18932 Wisconsin Univ. - Madison.

LOWER HYBRID HEATING ASSOCIATED WITH MODE CONVERSION ON THE WISCONSIN OCTUPOLE Ph.D. Thesis

Thomas Llewellyn Owens 1979 190 p
Avail: Univ. Microfilms Order No. 7928655

A series of 1-10ms pulses of up to 40kW of radio frequency power at 140MHz were launched corresponding to the hot plasma lower hybrid resonance in the octupole. Coupling efficiencies greater than 95% were achieved by proper antenna placement near the edge of the plasma radial density profile. Substantial ion body temperature increases of delta T sub i = 37 eV (delta T sub i/T sub io = 12) in a helium plasma were measured from Doppler broadening of the helium 4686 Angstrom line using a Fabry-Perot interferometer. From spatial scans of ion temperature using a miniature transverse ion energy analyzer in a hydrogen plasmas, heating efficiencies in the range of 16-50% were found. The higher efficiencies in this range occur for denser plasmas. Dissert. Abstr.

N80-18933 Wisconsin Univ. - Madison.

RADIAL CONFINEMENT OF CENTRAL CELL PLASMA IN TANDEM MIRRORS Ph.D. Thesis

Lang I. Lao 1979 178 p
Avail: Univ. Microfilms Order No. 8001155

The single particle guiding center orbit analysis is carried out both numerically and analytically. It is demonstrated numerically using the magnetic field geometry and plasma parameters of the tandem reactor. The radial losses of particle and energy are studied in the fluid approximation. A set of transport equations are obtained by assuming the magnetic field in the three mirror cells to be square wells. A one dimensional tandem transport code was developed from a Tokamak code. Numerical solutions are obtained using parameters of PHAEDRUS and classical, resonant, and Bohm transport coefficients. It is demonstrated using the parameters of UW-TMR and resonant plateau ion transport coefficients that resonant radial transport can substantially lower the Q values of tandem mirror reactors. Dissert. Abstr.

N80-18934 Illinois Univ. at Urbana-Champaign.

MONTE CARLO SIMULATION OF NEUTRAL-BEAM INJECTION FOR MIRROR FUSION REACTORS Ph.D. Thesis

Ronald Lee Miller 1979 154 p
Avail: Univ. Microfilms Order No. 8004231

Energetic neutral-beam particles interact with the target plasma through electron-atom and ion-atom collisional ionization as well as ion-atom charge-transfer (charge-exchange) collisions to give a fractional trapping of the neutral beam and a loss of charge-transfer-produced neutrals which escape to bombard the reactor first wall. Appropriate interaction cross sections for these processes are calculated for the assumed anisotropic, non-Maxwellian plasma ion phase-space distributions. The target plasma is assumed to be confined by a Yin-Yang mirror-coil configuration and has distinct radial and axial density profiles as modeled in steady-state and three spatial dimensions. The energy and angular distributions of a population of neutral test particles are computed to give statistical estimates of neutral-beam trapping efficiency, non-uniform first-wall surface heating rates and first-wall sputtering-erosion for use in engineering-design calculations. A guide to the NUBIN computer is included. Dissert. Abstr.

N80-18935 Florida Univ., Gainesville.

STEADY-STATE AND TIME-DEPENDENT BEHAVIOR OF FUSION-FISSION HYBRID SYSTEMS Ph.D. Thesis

William Gerard Vernetson 1979 445 p
Avail: Univ. Microfilms Order No. 8002909

A stability analysis of point model systems representing pure fusioning plasmas as well as coupled fusion-fission systems was examined. The stability criteria for these systems were derived for constant plasma confinement conditions based on engineering perturbations of the system feedrate. The results of linearized point model plasma stability analysis of the thermal instability were shown to be applicable to hybrid plasmas and to be attainable from considerations of engineering related perturbations in the extrinsic plasma feedrate variable. A Tokamak fusion-fission hybrid design was selected for further analysis. The modeled hybrid system in linearized form was found to be stable provided certain hybrid plasma temperature and confinement time limits are met. Hybrid plasma behavior was examined under transient and overpower conditions. Dissert. Abstr.

N80-18936# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE INTERACTION OF LARGE-AMPLITUDE PLASMA WAVES WITH A MOVING ELECTRON PLASMA

Abraham C.-L. Chian Nov. 1979 11 p refs Submitted for publication
(INPE-1626-RPE/091) Avail: NTIS HC A02/MF A01

A fluid treatment of the interaction of large amplitude plasma waves with a moving electron plasma is presented. An exact dispersion relation is obtained. In addition, a condition for the occurrence of wavebreaking for the subluminous waves is determined. Author

N80-18937# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ON THE PROPAGATION OF RELATIVISTIC NONLINEAR ELECTROMAGNETIC WAVES IN A COLD PLASMA

Nov. 1979 36 p refs Submitted for publication
(INPE-1624-RPE/089) Avail: NTIS HC A03/MF A01

A general theory of relativistic nonlinear electromagnetic waves in a cold electron plasma is presented. Three modes of propagation are analyzed: (1) longitudinal waves, (2) transverse circularly polarized waves, and (3) coupled transverse-longitudinal waves. The dispersion relations are obtained. A number of relativistic and nonlinear effects are discussed. A.W.H.

N80-18938# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RELATIVISTIC NONLINEAR ELECTRON CYCLOTRON WAVES IN PLASMA
Abraham C.-L. Chian and Ruth B. Miranda Nov. 1979 10 p refs Submitted for publication
(INPE-1625-RPE/090) Avail: NTIS HC A02/MF A01

The propagation of relativistic nonlinear electron cylcotron waves in a cold streaming plasma is studied. The dispersion relation is analyzed and expressions for the resonance and cut-off frequencies are obtained. It is shown that the nonlinear dispersion relation for a streaming plasma can be obtained from the nonlinear dispersion relation for a stationary plasma by a Lorentz transformation. K.L.

N80-18939# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
WAVES IN HOT MAGNETIZED PLASMAS
J. A. Bittencourt Sep. 1979 72 p Revised
(INPE-1575-RRP/072) Avail: NTIS HC A04/MF A01

The fundamentals of plasma physics are considered. The theory of wave propagation in a hot plasma is extended to the case of a hot plasma immersed in an externally applied magnetic field. The characteristics of wave propagation in a plasma consisting of mobile electrons in a neutralizing background of stationary ions are analyzed in some detail for directions either parallel or perpendicular to the magnetic field. J.M.S.

N80-18940# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PARTICLE INTERACTIONS IN PLASMAS
J. A. Bittencourt Oct. 1979 48 p Revised
(INPE-1589-RPE/076) Avail: NTIS HC A03/MF A01

The dynamics of binary collisions are described and the concepts of differential scattering cross section, total scattering cross section, and momentum transfer cross section are introduced. These cross sections are explicitly calculated for the cases of the hard sphere model and of the Coulomb potential, due to the Debye shielding, are incorporated on the cross sections for the Coulomb potential. J.M.S.

N80-18941# Nagoya Univ. (Japan).
THERMAL CONDUCTIVITIES AND COEFFICIENTS OF THERMAL DIFFUSION OF A HIGH-TEMPERATURE PLASMA IN A UNIFORM MAGNETIC FIELD
Shobu Kaneko and Akihiro Yamao Jan. 1980 15 p refs
(IPPJ-432) Avail: NTIS HC A02/MF A01

The Boltzmann equation was used to evaluate the thermal conductivities and the coefficients of thermal diffusion of a plasma composed of electrons and singly charged positive ions. The distribution functions for electrons and ions are expanded in terms of Sonine's polynomials. Numbers of the expansion terms are changed from 6 to 50, and the convergence of this method is examined. Both the thermal conductivities and the coefficients of thermal diffusion evaluated from the expansions with 50 terms are shown to have accuracy of at least six decimal places for various strength of magnetic field. A.R.H.

N80-18942# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THEORETICAL ANALYSIS OF THE RESONANCE CONE IN AN INHOMOGENEOUS MAGNETOPLASMA COLUMN
H. Sanuki, T. Watanabe, and T. Ohnuma Jan. 1980 26 p refs
(IPPJ-433) Avail: NTIS HC A03/MF A01

The three dimensional behaviour of the high frequency resonance cone was investigated using an inhomogeneous slab magnetoplasma model under the quasistatic approximation and neglecting ion motion. The effect of finite k sub y and electron thermal motion are considered numerically, revealing that the cone angle is shifted to a slightly smaller angle and the reflection point also shifts toward the high density region compared with the results under the cold plasma approximation. Author

N80-18943# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MONTE CARLO SIMULATION OF PLASMA CONFINEMENT IN MIRROR AND CUSP FIELDS
Yukiharu Ohsawa and Tetsuo Kamimura Dec. 1979 28 p refs
(IPPJ-431) Avail: NTIS HC A03/MF A01

Plasma confinement times for mirror and cusp devices are investigated by using a Monte Carlo simulation model which can include the effects of binary collisions, arbitrary spatial change in the magnetic field, and external electric fields. For a mirror, the simulation results are in good agreement with theory. For a cusp (without an external electric field), the confinement time is found to be proportional to the plasma radius divided by the average velocity, which is approximately the same as the theoretical confinement time, but is quite different from that obtained from the Nagoya experiments. Collision effects are also considered. A.R.H.

N80-18944# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EXPLOSION OF STRANGE ATTRACTORS EXHIBITED BY DUFFING'S EQUATION
Yoshisuke Ueda (Kyoto Univ.) Dec. 1979 19 p refs
(IPPJ-430) Avail: NTIS HC A02/MF A01

Using analog and digital computers, the motion exhibited by Duffing's equation (called the chaotically transitional process) was investigated. The results obtained and the unsolved problems developed from them are summarized. Special attention is directed towards the transition of the processes under the variation of the system parameter. R.E.S.

N80-18945*# Miami Univ., Oxford, Ohio.
HIGH PRESSURE LASER PLASMA STUDIES Final Report
W. E. Wells 1980 63 p refs
(Grant NsG-1383)
(NASA-CR-162824) Avail: NTIS HC A04/MF A01 CSCL 20I

The operation of a nuclear pumped laser, operating at a wavelength of 1.79 micron m on the 3d(1/2-4p(3/2) transition in argon with helium-3 as the majority gas is discussed. The energy pathways in He-Ar gas were investigated by observing the effects of varying partial pressures on the emissions of levels lying above the 4p level in argon during a pulsed afterglow. An attempt is made to determine the population mechanisms of the 3d level in pure argon by observing emission from the same transition in a high pressure plasma excited by a high energy electron beam. Both collisional radiative and dissociative recombination are discussed. A.R.H.

N80-18946*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL RESULTS ON PLASMA INTERACTIONS WITH LARGE SURFACES AT HIGH VOLTAGES
Norman T. Grier 1980 12 p refs Presented at 18th Aerospace Sci. Meeting, Pasadena, Calif., 14-16 Jan. 1980; sponsored by AIAA
(NASA-TM-81423; E-346) Avail: NTIS HC A02/MF A01 CSCL 20I

Multikilowatt power levels for future payloads can be more efficiently generated using solar arrays operating in the kilovolt range. This implies that large areas of the array at high operating voltages will be exposed to the space plasma environment. The resulting interactions of these high voltage surfaces with space plasma environments can seriously impact the performance of the satellite system. The plasma-surface interaction phenomena were studied in tests performed in two separate vacuum chambers, a 4.6 m diameter by 19.2 long chamber and a 20 m diameter by 27.4 m long chamber. The generated plasma density was approximately 1x10 to the 4th power/cu cm. Ten solar array panels, each with areas of 1400 sq cm were used in the tests. Nine of the solar panels were tested as a composite unit in the form of a 3x3 solar panel matrix. The results from all the tests confirmed small sample tests results: insulators were found to enhance the plasma coupling current for high positive bias and arcing was found to occur at high negative bias. A.R.H.

N80-18947*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EXPERIENCE WITH ARC-HEATER SIMULATION OF OUTER PLANET ENTRY RADIATION
W. L. Wells and W. L. Snow Jan. 1980 30 p refs
(NASA-TM-80192) Avail: NTIS HC A03/MF A01 CSCL 14B

An electric arc heater was operated at 800 amperes and

100,000 pa (1 atm) with hydrogen, helium, and two mixtures of hydrogen and helium. A VUV-scanning monochromator was used to record the spectra from an end view while a second spectrometer was used to determine the plasma temperature using hydrogen continuum radiation at 562 nm. Except for pure helium, the plasma temperature was found to be too low to produce significant helium radiation, and the measured spectra were primarily the hydrogen spectra with the highest intensity in the pure hydrogen case. A radiation computer code was used to compute the spectra for comparison to the measurements and to extend the study to simulation of outer planet entry radiation. Conductive cooling prevented ablation of phenolic carbon material samples mounted inside the arc heater during a cursory attempt to produce radiation absorption by ablation gases.
Author

N80-18948# Naval Research Lab., Washington, D. C. Plasma Physics Div.
ELECTROMAGNETIC INSTABILITIES IN A FOCUSED ION BEAM PROPAGATING THROUGH A Z-DISCHARGE PLASMA Interim Report
P. F. Ottinger, D. Mosher, and Shyke A. Goldstein Oct. 1979 26 p refs
(Contract ES-77-A-01-6021)
(AD-A076154; NRL-MR-4088) Avail: NTIS HC A03/MF A01 CSCL 20/9

A beam-plasma system consisting of a focused light ion beam propagating through a z-discharge plasma is analyzed for electromagnetic velocity space instabilities. In particular, the Weibel and the Whistler instabilities are studied. It is found that unstable modes do not grow fast enough to affect the beam propagation in a pellet-fusion-reactor chamber. GRA

N80-18949# Stanford Univ., Calif. Inst. for Plasma Research.
EVOLUTION OF TURBULENCE BY THREE-DIMENSIONAL NUMERICAL PARTICLE-VORTEX TRACING
Benoit Couet Aug. 1979 145 p refs
(Contract N00014-78-C-0272)
(AD-A076121; SU-IPR-793) Avail: NTIS HC A07/MF A01 CSCL 20/9

A new method for the numerical simulation of three-dimensional incompressible flows is described. Our vortex-in-cell (VIC) method traces the motion of the vortex filaments in the velocity field which these filaments create. The velocity field is not calculated by creating a mesh-record of the vorticity field, then integrating a Poisson's equation via the fast Fourier transform to get the stream function and generating a mesh-record of the velocity field. The computed scales of motion are assumed to be essentially inviscid. Viscous or subgrid-scale effects are incorporated into a filtering procedure in wave vector space. Three computational experiments were pursued in three-dimensional space. The velocity of translation of a single vortex ring was measured and compared with the Biot-Savart law. Next, the evolution in time of an infinite periodic array of closed vortex filaments (Taylor-Green) was studied. The third simulation follows a mixing layer from an initial state of uniform vorticity with two- and three-dimensional small perturbations. Streamwise perturbations lead to the usual roll-up of vortex patterns with spanwise uniformity. GRA

N80-18950# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THEORY OF SECOND HARMONIC ELECTRON CYCLOTRON RESONANCE HEATING OF TOKAMAK PLASMA Interim Report
Bertram Hui, Edward Ott, K. R. Chu, and Thomas Antonsen (MIT, Cambridge, Mass.) 26 Oct. 1979 16 p refs
(AD-A077538; AD-E000336; NRL-MR-4104) Avail: NTIS HC A02/MF A01 CSCL 20/9

A theoretical and numerical study of Tokamak plasma heating by the second harmonic of the electron cyclotron resonance is presented. It is found that the extraordinary mode is very efficiently absorbed. In contrast to previous calculations, it is also found that the ordinary mode is well absorbed at oblique incidence to the toroidal magnetic field. This finding indicates the feasibility of heating devices of higher densities than would otherwise be possible. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N80-18951* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND APPARATUS FOR SLICING CRYSTALS Patent
John S. J. Benedicto, Bruce E. Woodgate, and Frederick C. Hallberg, inventors (to NASA) Issued 22 Jan. 1980 5 p Filed 15 May 1978 Supersedes N78-24386 (16 - 15, p 1978)
(NASA-Case-GSC-12291-1; US-Patent-4,184,472;
US-Patent-Appl-SN-906298; US-Patent-Class-125-23R;
US-Patent-Class-51-235; US-Patent-Class-83-152;
US-Patent-Class-83-870; US-Patent-Class-269-21) Avail: US Patent and Trademark Office CSCL 20B

The crystal slicing method is described as follows. A crystal is sliced in a plane parallel to flat, opposed parallel end faces of the crystal. The end faces of the crystal are gripped by a pair of opposed, perforated platens of a pair of vacuum chambers, one of which is translatable relative to the other. A blade cuts the crystal through the desired plane. A spring biases one of the vacuum chambers away from the other vacuum chamber while both of the faces are gripped by the vacuum chambers and the blade is cleaving the crystal. A sliced portion of the crystal gripped by one of the vacuum chambers is pulled away from the remainder of the crystal gripped by the second vacuum chamber when the crystal was cleaved by the blade through the plane. Official Gazette of the U.S. Patent and Trademark Office

N80-18952 State Univ. of New York at Stony Brook.
SILICATE MINERALS AT PRESSURE: CRYSTAL STRUCTURES AND ELASTICITY Ph.D. Thesis
Louise Levien 1979 228 p
Avail: Univ. Microfilms Order No. 8004410

Unit-cell and crystal structure parameters were measured on single crystals of four minerals mounted in diamond-anvil high pressure cells. Isothermal bulk moduli and their pressure derivatives were calculated by fitting the pressure and unit-cell volume data to a Birch-Murnaghan equation of state. The single-crystal moduli of diopside were determined using a method based on the phenomenon of Brillouin scattering. All Si-O-Si angles in these minerals decreased with increased pressure; that in quartz changes most. As pressure is increased, small decreases in the average silicate tetrahedral bond lengths took place in all four crystallographically unique tetrahedra studied. Larger decreases were observed in the average polyhedral distances in diopside. Dissert. Abstr.

N80-18953 Lyon Univ. (France).
CRYSTAL SITES MODELS Ph.D. Thesis
Yves Emile Boudeville 1977 207 p
Avail: Univ. Microfilms Order No. 8003229

The crystalline site where the doping transition metal ion is located in the crystalline matrix is examined. The features of these sites are found by models growing from six to two thousand atoms by applying parametrized crystal field theory. Variation laws for parameters are established according to the size of the models. For 2000 atoms model, conventional values of parameters are found accordingly to crystal field theory. An approach of (010) surface, defects, and holes is performed. In order to correlate catalytic selectivity and covalency of binding, studies on the electronic state of sites and the atoms, charges are performed on EHT-SCCC-MO models from 7 to 17 atoms, including 3 transition metal ions. These calculations are compared to more extended CNDO/2 studies using 33 atoms with 11 transition metal cations. Different forms of covalent binding are analyzed. Dissert. Abstr.

N80-18954 Illinois Univ. at Urbana-Champaign.
EXTREMAL EFFECTS IN ROTATIONALLY INELASTIC DIFFRACTION Ph.D. Thesis
Lynn Charles Rathbun 1979 130 p
Avail: Univ. Microfilms Order No. 8004259

The scattering of the hydrogenic molecules H2, D2, and

HD from vacuum cleaved MgO (001) along the /110/ azimuth was studied. A thermal beam at 300 K and 80 K was used. Emphasis was placed on the rotational inelastic processes which accompany diffraction of HD. The scattering of helium along both the /110/ and the /100/ azimuths was studied. Anomalous shifts and structure were seen in the diffraction lobes for scattering along the /110/ azimuth. Dissert. Abstr.

N80-18955 Lehigh Univ., Bethlehem, Pa.

ULTRAVIOLET SPECTROSCOPY OF ELECTRON TRAPPING CENTERS IN THERMALLY GROWN SiO FILMS **Ph.D. Thesis**

Dennis Dean Rathman 1979 246 p
Avail: Univ. Microfilms Order No. 8003066

Electron trapping centers found in thermally grown silicon dioxide films were studied. Thick SiO2 films contain a number of distinct electron trapping centers which were characterized by such quantities as their capture and photoionization cross sections. These quantities were determined from the study of the kinetics of both the trap filling and trap emptying processes. The kinetics of these processes were interpreted in terms of models incorporating first order rate equations. The photon energy dependence of the emptying process was studied for the photon energy range of 4 to 7 eV. Three distinct electron trapping centers were observed in wet, thermal oxide films which were not previously characterized by such quantities listed above. Dissert. Abstr.

N80-18956 Lehigh Univ., Bethlehem, Pa.

BOUND SMALL POLARON TRANSITIONS IN MAGNESIUM OXIDE AND BERYLLIUM OXIDE **Ph.D. Thesis**

Lewis Howard Mammel, Jr. 1979 162 p
Avail: Univ. Microfilms Order No. 8003063

An extended version of the bound small polaron model was used to calculate optical absorption spectra of BeO:[Li]0, MgO:[Li]0, and MgO:V(-). Zeroth and first moment shifts of the magnetic circular dichroism spectra were calculated for MgO:[Li]0. The extended model includes O(-) ion pi orbitals as well as pi orbitals and allows for dipole matrix elements arising from direct overlap as well as from admixture. The calculations were made using a Monte Carlo method whereby the vibrational motion of the lattice is taken into account by calculating electronic transitions at many different randomly distributed lattice configurations using a restricted form of vibronic coupling. It was found that important features of the spectra remain unaccounted for in spite of the extensions employed in the model. A suggestion is made for further work which might provide a more complete interpretation. Dissert. Abstr.

N80-18957 Illinois Inst. of Tech., Chicago.

NONLINEAR ULTRASONIC PARAMETRIC PROCESSES IN PIEZOELECTRIC SEMICONDUCTORS AND FERROELECTRIC INSULATORS **Ph.D. Thesis**

John Ephstrates Economou 1979 154 p
Avail: Univ. Microfilms Order No. 8003646

A phenomenological analysis is presented that takes into consideration the contributions of the nonlinear material coefficients to several nonlinear ultrasonic parametric processes in piezoelectric semiconductors and ferroelectric insulators. It is concerned specifically with: (1) ultrasonic frequency mixing phenomena, such as second harmonic and subharmonic generation; (2) the omega-2 omega three wave parametric process (phonon echo process) in which the interaction of pump (radiation) field at frequency 2 omega with an acoustic wave at frequency omega generates a backward traveling acoustic wave at frequency omega; and (3) the mixing of two acoustic waves to generate a microwave radiation field. Dissert. Abstr.

N80-18958 Illinois Univ. at Urbana-Champaign.

HYDROGEN CHEMISORPTION AND OXIDATION ON TRANSITION METAL CARBIDES **Ph.D. Thesis**

James Roger Bethin 1979 91 p
Avail: Univ. Microfilms Order No. 8004134

The catalytic activity of tungsten carbide was investigated with emphasis on the possible influence of point defects. The chemisorption of hydrogen on tungsten carbide and titanium oxycarbides was studied with differential scanning calorimetry. The catalytic activity of these materials for oxidation of hydrogen was determined by potentiostatic steady state and potentiodynamic measurements in acid electrolyte. Compositions of tungsten carbide surfaces were determined by X-ray photoemission and related to the catalytic behavior. Titanium oxycarbide surfaces were analyzed by Auger electron spectroscopy. Of the carbides tested only one WC preparation was able to chemisorb hydrogen. Both WC powders investigated catalyzed hydrogen oxidation with similar specific activities. Dissert. Abstr.

N80-18959 Cornell Univ., Ithaca, N. Y.

STRUCTURAL AND TRANSPORT PROPERTIES OF SIMPLE METALS UNDER HIGH PRESSURE **Ph.D. Thesis**

Joseph Benjamin Wai Tung Cheung 1979 232 p
Avail: Univ. Microfilms Order No. 8003906

The effect core polarization fluctuations have on the total energy of a metal were reviewed. A generalized Hamiltonian was analyzed with emphasis on the interactions of the core electrons. Perturbation theory was used to yield expressions for the contributions to the total energy. It is found that the core fluctuations, in addition to producing screened van der Waals interactions between the ions, also screen the various interactions in the metal and that the screening effects can be incorporated into a core dielectric function. An interpolation formula for the core dielectric function was obtained and the results were applied to the calculation of the equation of state of potassium. Results indicate that in potassium core effects contribute rather significantly to the energy and the equation of state. Dissert. Abstr.

N80-18960 California Univ., Santa Barbara.

HIGH TEMPERATURE EPR STUDY OF SUPERIONIC CONDUCTORS AND STRONGLY EXCHANGE COUPLED PARAMAGNETS **Ph.D. Thesis**

Cesar Augusto Por Deus Evora 1978 145 p
Avail: Univ. Microfilms Order No. 8003034

High temperature electron paramagnetic resonance (EPR) in solids was studied. The aspects covered were: (1) F(-) anion diffusion and the dynamic modulation of the crystalline field as it affects the ERP of a Mn2(+) impurity in the superionic conductor PbF2; and (2) the persistence of superexchange into the molten state of a paramagnet (MnF2), using fast relaxing, exchange coupled impurities to distinguish the effects of exchange from motional narrowing of the EPR above the melting point, T sub M. In the superionic conductor PbF2 the collapse of the F19 transferred hyperfine structure of the Mn2(+) EPR above 400 K is explained by F(-) anion diffusion. Above 620 K a linewidth dependence on the nuclear spin quantum number M55 of each Mn55 hyperfine component was observed. Using the Redfield relaxation theory it shown that this effect is caused by the dynamic modulation of the crystal field. Dissert. Abstr.

N80-18961 Princeton Univ., N. J.

ELECTROCHEMICAL KINETICS AT METAL AND SEMICONDUCTOR SURFACES: ROLE OF INTERFACIAL ENERGY BARRIERS **Ph.D. Thesis**

Harold Edward Hager 1979 157 p
Avail: Univ. Microfilms Order No. 8003786

The incorporation of ionic adsorption phenomena into electrochemical kinetic expressions is examined. Here the influence of specifically adsorbed ions upon the potential structure of the double layer is determined. This result is employed to interpret solution concentration effects observed in several reported hydrogen oxidation/reduction studies on platinum. The role of ionic half cell reaction products upon the performance characteristics of a photoassisted electrochemical cell is analyzed. The stability of semiconductor materials employed as photoelectrodes in water electrolysis systems is investigated. The feasibility of employing simple coating schemes to stabilize photocorrodible photoanode materials is discussed. Charge transport and electron/hole pair recombination in a photoassisted electrochemical cell are treated theoretically. An experimental program is outlined for the determination of the recombination velocity as a function of the system bias, illumination intensity, and electrolyte. Dissert. Abstr.

N80-18962 Pittsburgh Univ., Pa.

AN EXPERIMENTAL STUDY OF THE PHASE SEPARATION PROCESS NEAR THE CRITICAL POINT **Ph.D. Thesis**

Arthur Jay Schwartz 1979 134 p
Avail: Univ. Microfilms Order No. 8004876

A method developed for performing quenches on samples in their critical region and probing the phase separation process by light scattering is described. The spinodal ring, a maximum as a function of angle in the scattered cross section as measured by light scattering was examined. The maximum intensity of the scattering as well as its angular position were studied as a function of quench depth and composition. The limits of metastability were probed by quenching samples held off the critical isochore until spontaneous phase separation occurred.
Dissert. Abstr.

N80-18963 Lehigh Univ., Bethlehem, Pa.
DEEP LEVEL TRANSIENT SPECTROSCOPY STUDIES OF RADIATION INDUCING DEFECTS IN SILICON Ph.D. Thesis
John Richard Troxell 1979 338 p
Avail: Univ. Microfilms Order No. 8003072

The use of deep level transient spectroscopy (DLTS) in characterizing lattice defects produced in silicon by electron irradiation both at room temperature and in situ at liquid helium temperatures is discussed. The electrical properties of the defects are cataloged and correlated with the results of electron paramagnetic resonance studies in order to identify the defect levels. Schottky barrier diodes, diffused, and ion implanted junctions are studied. Studies of the isolated vacancy, interstitial boron, and interstitial aluminum are reported. The construction of the DLTS spectrometer and the fabrication of the samples are considered.
Dissert. Abstr.

N80-18964 Illinois Univ. at Urbana-Champaign.
STUDIES IN THE ELECTRONIC STRUCTURE OF MATTER Ph.D. Thesis
Coenraad Albert Swarts 1979 349 p
Avail: Univ. Microfilms Order No. 8004284

The results of various theories for the angular distribution of electrons photoemitted from the outer most p shell of rare gas atoms are compared. The theories compared are: (1) the local density theories of Slater and of Hohenberg, Kohn and Sham; (2) the pseudopotential method; (3) Hartree-Fock theory; and, (4) Amusia's random phase approximation with exchange. It is shown that the local density theories, although simple, generally fail to produce a reliable cross section. Extended Horckel theory is applied to GaAs, GaP and to the nitrogen isoelectronic trap in GaAs and GaP. The computed perfect crystal band structures are found to be in reasonable agreement with those computed with empirical pseudopotentials. By means of model calculations for an independent electron metal, exact lineshapes for the photon absorption, emission, and photoemission spectra of deep core states are obtained.
Dissert. Abstr.

N80-18965# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES 25: THE P-GaAs/HEATYL VIOLOGEN SYSTEM. PHOTOELECTROCHEMICAL CELLS AND PHOTOELECTROCHROMIC DISPLAYS Technical Report, 1 Sep. 1979 - 31 Aug. 1980
Benjamin Reichman, Fu-Ren F. Fan, and Allen J. Bard 1 Oct. 1979 30 p refs Submitted for publication
(Contract N00014-78-C-0592)
(AD-A075812; TR-2) Avail: NTIS HC A03/MF A01 CSCL 20/12

The photoreduction of aqueous solutions of 1,1:-diheptyl-4,4:-bipyridyl (heptyl viologen, HV(2-)) bromide on p-GaAs was investigated. Under irradiation with light of wavelengths below 885 nm, the photoreduction of HV(2-) to form a precipitate of violet HVBr occurs on p-GaAs at a potential of approx 400 mV more positive than the reversible potential of the HV(2-)/HVBr couple on Pt. Oxidation of HVBr back to soluble HV(2-) occurs in the dark at more negative potentials. Photoelectrochemical low capacity storage cells based on this reaction with Cu, Ni, or HxNb2O5 counter electrodes were constructed. In such cells, under illumination, the p-GaAs electrode behaves as the cathode, a photovoltage develops and current flows in the external circuit, while HVBr precipitates on the electrode surface and the counter electrode is oxidized. In the dark, the current flows in the opposite direction, the p-GaAs is the anode and reduction occurs at the counter electrode. Such a cell also produces an alternating electrical output under periodic illumination. Photoelectrochromic cells based on this reaction and utilizing simultaneous addressing with light and electrical signals are also proposed. GRA

N80-18966# Texas Univ. at Austin. Dept. of Chemistry.
SEMICONDUCTOR ELECTRODES 27: THE P- AND N-GaAs-N, N'-DIMETHYL-4, 4'-BIPYRIDINIUM SYSTEM, ENHANCEMENT OF HYDROGEN EVOLUTION ON P-GaAs AND STABILIZATION OF N-GaAs ELECTRODES Technical Report, 1 Sep. 1979 - 31 Aug. 1980
Fu-Ren F. Fan 1 Oct. 1979 26 p refs
(Contract N00014-78-C-0592)
(AD-A075813; TR-3) Avail: NTIS HC A03/MF A01 CSCL 20/12

The photoelectrochemical (PEC) behavior of N,N:-dimethyl-4,4:-bipyridinium (methyl viologen,MV (2-) at p- and n-type GaAs electrodes in aqueous solutions was studied. The reduction of MV(2-) at irradiated p-GaAs occurs at potentials approx. 450 mV less negative than those found at Pt electrode. The catalyzed reaction of the Photogenerated MV with water to produce hydrogen by irradiation of p-GaAs was demonstrated and the use of the MV-system as an intermediate in the photoassisted generation of hydrogen at semiconductors with high hydrogen over potentials suggested. The photooxidation of MV at n-GaAs occurred at potentials approx. 0.8 V less positive to those where the oxidation takes place at Pt. PEC cells of the form n-GaAs or p-GaAs/MV(2-),MV/M were also constructed.
GRA

N80-18967# Vermont Univ., Burlington. Dept. of Chemistry.
APPLICATIONS OF THE MOESSBAUER EFFECT TO THE STUDY OF MIXED-VALENCE COMPOUNDS
David B. Brown and James T. Wrobleski Nov. 1979 33 p refs
(Contract N00014-75-C-0756)
(AD-A077640; TR-19) Avail: NTIS HC A03/MF A01 CSCL 07/3

The principal utility of Moessbauer Effect spectroscopy in the study of mixed-valence materials is its ability (through measurement of the chemical shift) to distinguish between different oxidation states of the same element in similar chemical environments. By using Moessbauer Effect spectroscopy it is possible to distinguish between trapped and delocalized valence states in mixed-valence compounds. In addition, the rather long lifetime of the Moessbauer experiment, as compared to other forms of spectroscopy, permits evaluation of the rate of intervalence electron exchange in mixed-valence materials. GRA

N80-18968# RCA Labs., Princeton, N. J.
HIGH-ENERGY ION IMPLANTATION FOR MULTIGIGABIT-RATE GaAs INTEGRATED CIRCUIT Annual Report, 15 May 1978 - 14 May 1979
S. G. Liu, E. C. Douglas, and C. P. Wu Aug. 1979 79 p refs
(Contract N00014-78-C-0367; RF54582001)
(AD-A076237; PRRL-79-CR-37) Avail: NTIS HC A05/MF A01 CSCL 13/8

The program objectives are: study of high-energy (about 1 MeV) ion implantation of donors into GaAs for multigigabit-rate integrated-circuit development and annealing of implanted GaAs using high-power lasers to remove lattice damage and activate implanted donors. Results obtained are: We have investigated implantation of 28Si(-) into semi-insulating GaAs with implant energies ranging from 40 keV to 1.2 MeV; we have analyzed the profiles and range statistics of 28Si-implanted GaAs with energies of up to 1.2 MeV using (Secondary Ion-Mass Spectroscopy) SIMS; we have investigated laser-annealing of high-dose Si-implanted GaAs using both a high-power Nd:glass laser and a ruby laser; optical absorption in Si-implanted GaAs wafers irradiated with high-power Nd:glass laser pulses has been studied; impurity distribution in as-implanted, thermally annealed, and laser-annealed samples has been investigated by SIMS; and investigation of 28Si(-) implantations in GaAs at the low-implant energy (-300 keV) shows that the electron concentration attained has an upper limit at the high-dose region and a lower limit at the low-dose region following thermal annealing. GRA

N80-18969# Pennsylvania State Univ., University Park. Materials Research Lab.
TEMPERATURE COMPENSATED PIEZOELECTRIC OXIDE

MATERIALS Final Report, 23 Feb. 1977 - 30 Nov. 1978
G. R. Barsch and K. E. Spear Sep. 1979 52 p refs
(Contract F19628-77-C-0131; AF Proj. 2305)
(AD-A077650; RADC-TR-79-219) Avail: NTIS
HC A04/MF A01 CSCL 20/2

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation and high electromechanical coupling, the following investigations were carried out: (1) Crystal growth for lead potassium niobate (PKN), Pb2KNb5O15 and for lithium metasilicate, Li2SiO3 by using the Czochralski method; (2) The complete set of elastic, dielectric and piezoelectric constants and of their temperature coefficients is reported for unpoled PKN; (3) The piezoelectric strain constants d(11) and d(14) of alpha-berlinite have been measured by the static x-ray method. The piezoelectric stress constants e(11) and e(14) calculated from these results are larger than the values previously determined ultrasonically; (4) The dielectric constant and the loss tangent of alpha-berlinite were measured from 1,000 to 1,000,000 Hz between -175 and -200 C. Two relaxation peaks are present in the loss tangent; and (5) In order to assess the reliability of the x-ray method the piezoelectric strain constants d(11) and d(14) of alpha-quartz were measured with this method. The value obtained for d(11) is in excellent agreement with the results obtained by other experimental methods. The value of d(14) obtained from the (024) reflection is about 30 percent larger than the values obtained by other methods. GRA

N80-18970# Spectrolab, Inc., Sylmar, Calif.
LOW RESISTIVITY-HIGH MINORITY CARRIER LIFETIME SINGLE CRYSTAL SILICON INVESTIGATION Interim Report, Jul. 1977 - Sep. 1978
Paul M. Stella and R. W. Opjorden Apr. 1979 50 p refs
(Contract F33615-77-C-2045; AF Proj. 2308)
(AD-A077684; AFAPL-TR-79-2031) Avail: NTIS
HC A03/MF A01

The objective of this program is to improve the performance of N+/P silicon solar cells by improving the minority carrier lifetime of moderate to low resistivity silicon material. The behavior of cells fabricated from improved material will be demonstrated by measuring electrical output without irradiation and after 1 Mev electrons and 10 MeV proton irradiation. This report discusses the first fifteen months' efforts toward developing and evaluating a new solar cell silicon material. During this time period, equipment and techniques for material growth have been developed along with analysis of methods for removing impurities from non-ultra pure silicon after wafer fabrication. Five preliminary ultra pure ingots have been grown using boron ion implantation and a single ingot using elemental gallium to provide the P dopant. Results are presented for solar cells made from the ingots. GRA

N80-18971# Naval Academy, Annapolis, Md.
DIPOLAR DEFECTS IN RARE-EARTH DOPED ALKALINE-EARTH FLUORIDES Final Report, 1978 - 1979
Michael K. Smith 15 May 1979 91 p refs
(AD-A077580; USNA-TSPR-99) Avail: NTIS
HC A05/MF A01 CSCL 20/2

It has become clear that simple point-defect models of relaxations in doped alkaline-earth fluorides are insufficient to explain experimental results. The idea that clusters of rare-earths may be associated with observed relaxations has been suggested. The writer attempted to study calcium fluoride crystals doped with two different rare-earth species, utilizing dielectric relaxation and ionic thermocurrent techniques to investigate the cluster hypothesis. If, in fact, a relaxation is associated with a dipolar cluster, hybrid relaxation involving both rare-earth species present should be observed. The finding (enclosed) provides useful new information concerning the defect structure of rare-earth doped calcium fluoride. GRA

N80-18972# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Summary Report, 1 Feb. - 30 Apr. 1979
Alan L. McWhorter 15 May 1979 88 p refs
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A078676; TR-1979-2; ESD-TR-79-150) Avail: NTIS
HC A05/MF A01 CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1979. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, ARPA, NSF, and DOE. GRA

N80-18973# Dayton Univ., Ohio.
APPLIED SURFACE ANALYSIS WORKSHOP Final Report
John T. Grant Oct. 1979 67 p Conf. held at Danton Univ., Ohio, 13-15 Jun. 1979
(Contract F33615-79-C-5130)
(AD-A078830; UDR-TR-79-67; AFML-TR-79-4153) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report describes the Applied Surface Analysis Workshop held at the University of Dayton, Dayton, Ohio on 13-15 June 1979. Thirty-eight papers were presented at the Workshop, five of them being from invited speakers. Approximately 100 scientists active in the field of surface analysis participated in the workshop. GRA

N80-18974# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF NONLINEAR CRYSTALS Final Report
Carol J. Kastner and Jack J. Grossman 30 Jul. 1979 95 p refs
(Contract N00173-78-C-0161)
(AD-A077570; MDC-G7887) Avail: NTIS HC A05/MF A01 CSCL 20/12

Contents: Prior Work on Correlation and Convolution; Experimental -- Joint Transform Correlator (JTC), Frequency Conversion Facilities, NRL Transparencies, Convolutions with Square Apertures, Use of Image Plane Filters - Two Crystal Experiments, Internal Reflections, SHG and Noise, Convolution Non-linearity, Convolution Peak Intensity Ratios, Crystal Damage, N-Pattern Test of CD*A; Appendix A-I MDAC Contract Review; Appendix A-II - Theory - The Convolution and Correlation Operations, Frequency Conversion, Soviet Papers, and Determination of Bit Shift. GRA

N80-18975# Oregon Graduate Center for Study and Research, Beaverton.
FIELD ELECTRON AND ION SOURCE RESEARCH FOR HIGH DENSITY INFORMATION STORAGE SYSTEM Final Technical Report, Sep. 1977 - Dec. 1978
L. W. Swanson, J. Orloff, and A. E. Bell May 1979 203 p refs
(Contract F33615-76-C-1327; AF Proj. 3164)
(AD-A078520; AFAL-TR-79-1133) Avail: NTIS
HC A10/MF A01 CSCL 20/12

The purpose of this research program is the evaluation and characterization of high brightness field electron and ion sources suitable for use in high density information storage systems. In addition, preliminary evaluation of focussing optics suitable for forming submicron beams of both ions and electrons has been performed. Several new field electron source materials including Mo, LaB6, SmB6 and HfC have been examined. In addition, a complete characterization and comparison between the Zr/W(100) and built-up W(100) emitters operating in the thermal-field (TF) mode is reported. Such source parameters as angular intensity, energy distribution, beam noise spectrum, and source life have been measured. GRA

N80-18976# Varian Associates, Palo Alto, Calif.
RESEARCH ON InGaAs FET'S Interim Report
S. Banoy, T. Boyle, R. Fulks, S. Hyder, and C. Nishimoto Sep. 1979 65 p refs
(Contract N00014-78-C-0380; RF54581001; NR Proj. 251-030)
(AD-A078816; TR-1) Avail: NTIS HC A04/MF A01 CSCL 20/12

Virtually the whole effort for this period was spent in trying to grow by Vapor Phase Epitaxy (VPE) dislocation-free InGaAs on GaAs at In percentages above 25%. Of all the techniques tried, significant improvement came only after installation of a H2 bypass on the reactor. Field Effect Transistors (FETs) fabricated on the best of the pre-H2 bypass wafers showed sub-GaAs values for the effective saturated velocity, and FETs have yet to be fabricated on the wafers grown with the H2 bypass. Efforts at ion-implanting the pre-H2 bypass wafers were not successful, presumably because of the heavy amount of dislocations in the material. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N80-18977 North Carolina Univ. at Chapel Hill.
INITIAL VALUE PROBLEMS ON NON-EUCLIDEAN TOPOLOGIES Ph.D. Thesis
Jeffrey Mann Bowen 1979 137 p
Avail: Univ. Microfilms Order No. 8005017

Einstein's equations of general relativity, studied as a Cauchy problem are presented. The equations are split into space-plus-time form, and the dynamical and kinematical variables are distinguished. The initial value equations are specialized to maximal, conformally flat initial spacelike hypersurfaces. Time symmetric solutions of the initial value equations are investigated. When the symmetry conditions are applied to the extrinsic curvature tensor, a simple form for the vacuum solution of the momentum constraint is obtained, representing an object with linear momentum. It is argued that the resulting three-geometry consists of two physically identical, asymptotically flat regions connected by an extremal area throat. Solutions including angular momentum and electric fields are also presented. The solutions found are purely geometric models that may represent moving, (classically) spinning, or electrically charged particles. Dissert. Abstr.

N80-18978 Wisconsin Univ. - Madison.
APPLICATION OF THE SECOND LAW TO THE ANALYSIS AND DESIGN OF ENERGY SYSTEMS Ph.D. Thesis
William Joseph Wepfer 1979 297 p
Avail: Univ. Microfilms Order No. 7926679

The Second Law concept of available energy and how it applies to thermodynamic analysis and thermoeconomic design of energy systems is presented. After an introduction to the basic concept of available energy is presented, efficiency analyses and economic analyses are discussed. Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N80-18979*# National Aeronautics and Space Administration, Washington, D. C.
NASA'S UNIVERSITY PROGRAM: ACTIVE PROJECTS, FISCAL YEAR 1979
1979 562 p
(NASA-TM-81777) Avail: NTIS HC A24/MF A01 CSCL 05A

Current information and related statistics are provided for each grant/contract/ cooperative agreement during the report period. Cross indexes by agreement number, field of science and engineering, and technical officer location are included. A.R.H.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-18980# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME RECENT DEVELOPMENTS IN MULTIPLE DECISION THEORY: A BRIEF OVERVIEW
Shanti S. Gupta and Deng-Yuan Huang Oct. 1979 15 p refs
(Contract N00014-75-C-0455)
(AD-A077710; Mimeo-Ser-79-26) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper surveys some recent developments in multiple decision (selection and ranking) theory. The spirit and philosophy underlying this approach to comparing k populations are discussed briefly. Criteria to construct optimal multiple decision procedures, which are based on some 'modifications' of decision theory, are discussed. The combination of the indifference zone and the subset selection approach into a general framework is described. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N80-18981 University of Southwestern Louisiana, Lafayette.
THE DESIGN AND IMPLEMENTATION OF A RELATIONAL AND NETWORK DATABASE ACCESS LANGUAGE Ph.D. Thesis
Donald Jules Simon 1979 146 p
Avail: Univ. Microfilms Order No. 8002716

A mapping oriented query language is described which can interface with either a relational or network data base. An extended query language utilizes the relational calculus and a CODASYL-type data manipulation language as target languages to map the user's query into the respective data model. The user need not know which relations or records contain which attributes; the user merely provides XQL with (1) the attributes or fields he wants retrieved, and (2) the conditions under which they are to be retrieved. Also, XGL provides the user with functions such as SORT, COUNT, AVERAGE, MIN, and MAX, and provides the users of both relational and network models with a straightforward method of interfacing with either model. Furthermore it allows the users of a network model to view the data in a tubular representation as users of the relational model do.Dissert. Abstr.

N80-18982 Duke Univ., Durham, N. C.
QUALITY OF DECISION VERSUS DEPTH OF SEARCH ON GAME TREES Ph.D. Thesis
Dana S. Nau 1979 145 p
Avail: Univ. Microfilms Order No. 8003633

In the field of game playing, good results have been obtained by searching the game tree to some arbitrary depth and heuristically estimating its characteristics beyond that depth. For such a heuristic game tree search, there is a consensus that the quality of the decision improves as the search depth increases, but this agreement is based purely on empirical evidence. A mathematical theory modeling the effects of search depth on the probability of making a correct decision using a heuristic game tree search was developed. This application produced the surprising result that there is an infinite class of game trees for which searching deeper does not increase the probability of making a correct decision, but instead causes the decision to become more and more random. A mathematical proof of this statement is presented along with experimental verification of it, and a discussion of its significance for decision making in general. Dissert. Abstr.

N80-18983 Florida Univ., Gainesville.
A SYSTEMATIC APPROACH TO LOGICAL DATABASE DESIGN Ph.D. Thesis
Der-Her Lo 1979 188 p
Avail: Univ. Microfilms Order No. 8002873

A step-by-step design process is presented which can guide the database designs to carry out the logical database designs systematically so that high quality databases can be obtained and the designer productivity can be increased. Topics covered include requirement analysis and specification, application modeling, application integration, DBMS schema generation, and query skeleton generation. A prototype of the computer-assisted logical database design and based on the described design process is implemented. Dissert. Abstr.

N80-18984 Princeton Univ., N. J.
DATA DEPENDENCIES IN RELATIONAL DATABASE SCHEMES Ph.D. Thesis
Alberto Oscar Mendelzon 1979 78 p
Avail: Univ. Microfilms Order No. 8003792

The tableau method for representing and manipulating database schemes is used for developing an algorithm to determine whether a given join dependency is a logical consequences of a set of functional, multivalued and join dependencies. A notion of equivalence of database schemes is introduced, based on the equality of the fixed-point sets of the associated project-join mappings. It is shown that the implication testing method can be applied to the determination of whether two database schemes are equivalent under a set of functional and join dependencies. Finally, the notion of lossless decompositions and fixed-points of a database scheme is examined by introducing generalized mutual dependencies. It is shown that generalized mutual dependencies are equivalent to a special type of join dependencies, and furthermore, any join dependency is equivalent to a generalized mutual dependency plus a set of multivalued dependencies. Dissert. Abstr.

N80-18985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES RESEARCH CENTER PUBLICATIONS: A CONTINUING BIBLIOGRAPHY, 1978
Feb. 1980 139 p
(NASA-TM-81175; A-8079) Avail: NTIS HC A07 CSCL 05B

This bibliography lists formal NASA publications, journal articles, books, chapters of books, patents and contractor reports issued by Ames Research Center which were indexed by Scientific and Technical Aerospace Abstracts, Limited Scientific and Technical Aerospace Abstracts, and International Aerospace Abstracts in 1978. Citations are arranged by directorate, type of publication and NASA accession numbers. Subject, personal author, corporate source, contract number, and report/accession number indexes are provided. Author

N80-18986*# Lockheed Electronics Co., Houston, Tex.
IMAGE SELECTION SYSTEM: OPERATOR'S PROCEDURES MANUAL
C. C. DeValcourt Oct. 1975 51 p
(Contract NAS9-12200)
(NASA-CR-160467; JSC-10657; LEC-4366) Avail: NTIS HC A04/MF A01 CSCL 05B

Essential retrieval parameter tables on the Image Selection System were consolidated from two separate operations manuals to provide on example of a typical retrieval session. A.R.H.

N80-18987# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
ON DATABASE MANAGEMENT SYSTEM ARCHITECTURE Interim Report
Michael Hammer and Dennis McLeod Oct. 1979 43 p refs
Prepared in cooperation with the Univ. of Southern California, Los Angeles
(Contract N00014-76-C-0944)
(AD-A076417; MIT/LCS/TM-141) Avail: NTIS HC A03/MF A01 CSCL 05/2

Despite the many advances that have been made in the field of database management in the last two decades, in many respects the paradigm of database management has not changed much since its inception. Several long-standing assumptions pervade the field and exert a great influence on the architecture of database management systems, their functions, and the kinds of databases that they manage. This paper reconsiders some of these assumptions and suggests certain alternatives to them. In particular, it is argued that the concept of an integrated database ought to be supplanted by that of a federated database, a loose assembly of semi-independent components; the position of the database management system in the context of a total information system is reexamined, and arguments are made for extending its functional capabilities; and controlled logical redundancy in the schema is introduced as a means of improving the usability of a database and of enhancing its life-cycle performance. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-18988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAMS FOR ESTIMATING CIVIL AIRCRAFT ECONOMICS
Dal V. Maddalon, John K. Molloy, and Milton J. Neubawer Jan. 1980 51 p refs
(NASA-TM-80196) Avail: NTIS HC A04/MF A01 CSCL 05C

Computer programs for calculating airline direct operating cost, indirect operating cost, and return on investment were developed to provide a means for determining commercial aircraft life cycle cost and economic performance. A representative wide body subsonic jet aircraft was evaluated to illustrate use of the programs. K.L.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-18989# Committee on International Relations (U.S. House).
INTERNATIONAL TRANSFER OF TECHNOLOGY
Washington GPO 1979 61 p refs Rept. of the President to the Congr. together with assessment of the rept. by the Congressional Res. Service for the Subcomm. on Intern. Security and Scientific Affairs of the Comm. on Intern. Relations, 95th Congr., 2d Sess., Dec. 1978
(GPO-37-153) Avail: SOD HC

The transfer of technology having significant national security implications are discussed in terms of the rational for the transfer from the United States to foreign countries. An assessment of the Executive response to the International Security Act is included. F.O.S.

N80-18990*# Transportation Systems Center, Cambridge, Mass.
IMPLICATIONS OF FUEL-EFFICIENT VEHICLES ON RIDE QUALITY AND PASSENGER ACCEPTANCE: WORKSHOP PROCEEDINGS Final Report, 6-8 Sep. 1979
Anna M. Wichansky, ed. and A. R. Kuhlthau, ed. (Virginia Univ.) Aug. 1979 120 p refs Conf. held at Woods Hole, Mass., 6-8 Sep. 1978
(NASA-CP-2096; DTS-532; DOT-TSC-RSPA-79-21) Avail: NTIS HC A06/MF A01 CSCL 13F

Topics discussed include ride quality and passenger acceptance problems associated with enhanced fuel efficiency of automobiles and aircraft shifts in intermediate range (100-500 miles) travel from automobiles to public transit and implications of increased size disparity for ground transport freight and passenger vehicles using shared guideways. Major problem areas were identified and strategies for conducting pertinent research were outlined. A glossary of technical terms is included. K.L.

N80-18991*# Brobeck (William M.) and Associates, Berkeley, Calif.
STUDY OF ADVANCED ELECTRIC PROPULSION SYSTEM CONCEPT USING A FLYWHEEL FOR ELECTRIC VEHICLES *Final Report*
Francis C. Younger and Heinz Lackner Dec. 1979 231 p refs
(Contracts DEN3-78; EC-77-A-31-1011)
(NASA-CR-159650; DOE/NASA/0078-79/1;
WMB/A-4500-131-3-R1) Avail: NTIS HC A11/MF A01 CSCL 10B

Advanced electric propulsion system concepts with flywheels for electric vehicles are evaluated and it is predicted that advanced systems can provide considerable performance improvement over existing electric propulsion systems with little or no cost penalty. Using components specifically designed for an integrated electric propulsion system avoids the compromises that frequently lead to a loss of efficiency and to inefficient utilization of space and weight. A propulsion system using a flywheel power energy storage device can provide excellent acceleration under adverse conditions of battery degradation due either to very low temperatures or high degrees of discharge. Both electrical and mechanical means of transfer of energy to and from the flywheel appear attractive; however, development work is required to establish the safe limits of speed and energy storage for advanced flywheel designs and to achieve the optimum efficiency of energy transfer. Brushless traction motor designs using either electronic commutation schemes or dc-to-ac inverters appear to provide a practical approach to a mass producible motor, with excellent efficiency and light weight. No comparisons were made with advanced system concepts which do not incorporate a flywheel. M.G.

N80-18992*# Brobeck (William M.) and Associates, Berkeley, Calif.
AN AUTOMATICALLY-SHIFTED TWO-SPEED TRANSAXLE SYSTEM FOR AN ELECTRIC VEHICLE Final Report, Dec. 1978 - Dec. 1979
Hayden S. Gordon and Gregory V. Hassman Jan. 1980 34 p refs
(Contracts DEN3-84; EC-77-A-31-1044)
(NASA-CR-159746; DOE/NASA/0084-79/1;
WMB/A-131-4-R2) Avail: NTIS HC A03/MF A01 CSCL 13F

An automatic shifting scheme for a two speed transaxle for use with an electric vehicle propulsion system is described. The transaxle system was to be installed in an instrumented laboratory propulsion system of an ac electric vehicle drive train. The transaxle which had been fabricated is also described. J.M.S.

N80-18993# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 1 Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss Dec. 1978 161 p
(Contract DI-BM-0255022)
(PB-299887/0; BM-OFR-103(1)-79) Avail: NTIS HC A08/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. Preliminary scale-model blasts were conducted at a quarry to provide basic data. Literature review is presented. GRA

N80-18994# Wiss, Janney, Elstner and Associates, Inc., Northbrook, Ill.
CONTROL OF VIBRATION AND BLAST NOISE FROM SURFACE COAL MINING, VOLUME 2 Final Report, 1 Jul. 1975 - 28 Feb. 1978
John F. Wiss and Patrick W. Linehan Dec. 1978 282 p
(Contract DI-BM-J0255022)
(PB-299888/8; BM-OFR-103(2)-79) Avail: NTIS HC A13/MF A01; also available in set of 4 reports HC E16 as PB-299886-SET CSCL 13F

A series of controlled experiments was conducted at four surface coal mines to study the effects of certain blast parameters upon the ground and air vibration. The experiments conducted at the mines are described and the variables evaluated are identified. The effects of the variables upon the peak amplitudes and frequency content of the seismic and air vibrations are included. GRA

N80-18995# National Technical Information Service, Springfield, Va.
TECHNOLOGY TRANSFER: GENERAL AND THEORETICAL STUDIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Dec. 1979
Mary E. Young Dec. 1979 186 p Supersedes NTIS/PS-78/1274; NTIS/PS-77/1131; NTIS/PS-76/1008; NTIS/PS-75/884; COM-74-1194
(PB80-801509; NTIS/PS-78/1274; NTIS/PS-77/1131; NTIS/PS-76/1008; NTIS/PS-75/884; COM-74-11194) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

The cited reports cover research in technology transfer from 1977 to December, 1978. Topics on Government policies, aid to developing countries, feasibility studies, proposed methodologies, and theory are included. This updated bibliography contains 178 abstracts, 55 of which are new entries to the previous edition. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-18996 Colorado Univ. at Boulder.
SUPERGIANT CHROMOSPHERES Ph.D. Thesis
Gibor Saul Basri 1979 143 p
Avail: Univ. Microfilms Order No. 8002958

Observations with high spectral resolution that are calibrated in absolute flux units at the stellar surface are used to construct preliminary models of three late-type supergiants; beta Dra (G211) equal to Gem (G8Ib)), and Ori(M2Iab). The details of chromospheric emission formation in the low density atmospheres of supergiants are studied using partial redistribution radiative transfer codes. The strong coherency of the resonance line wings has a profound effect on the appearance of the emergent line profile and on the physical properties of the atmosphere that can be derived from it. Dissert. Abstr.

N80-18997*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ASSESSMENT OF GROUND-BASED TECHNIQUES FOR DETECTING OTHER PLANETARY SYSTEMS. VOLUME 1: AN OVERVIEW
David C. Black, ed. and William E. Brunk, ed. (NASA, Washington, D.C.) Feb. 1980 48 p refs Workshop held at Cambridge, Mass., Nov. 1979
(NASA-CP-2124; A-8002) Avail: NTIS HC A03/MF A01 CSCL 03A

The feasibility and limitations of ground-based techniques for detecting other planetary systems are discussed as well as the level of accuracy at which these limitations would occur and the extent to which they can be overcome by new technology and instrumenation. Workshop conclusions and recommendations are summarized and a proposed high priority program is considered. A.R.H.

N80-18998# Southampton Univ. (England). Dept. of Physics.
BALLOON-BORNE OBSERVATIONS OF NGC 4611 USING THE MISO TELESCOPE
F. Perotti, A. DellaVentura, G. Sechi, G. Villa, G. DiCocco (CNR, Bologna), R. E. Baker, R. C. Butler, A. J. Dean, S. J. Martin, and D. Ramsden Sep. 1979 5 p refs Sponsored jointly by UK Sci. Res. Council and CNR Prepared in cooperation with CNR
Avail: NTIS HC A02/MF A01

The Seyfert Galaxy NGC 4151 was observed from balloon altitudes using the MISO low energy gamma-ray telescope on May 23, 1977. The spectrum was measured over the range 0.04 to 20 MeV and a change in the spectral index was observed at about 2 MeV. The data at low energies are in good agreement with other hard X-ray data, but at higher energies the data are consistent with an exponential spectrum having an e-folding energy of 2.1 MeV. Author (ESA)

N80-18999# Royal Observatory, Edinburgh (Scotland).
[ASTRONOMICAL ACTIVITIES, 1977 - 1978] Annual Report
1978 54 p refs
(ISBN-0-9025-5321-6) Avail: NTIS HC A04/MF A01

The operation of celestial observation facilities, results obtained, and research projects for the year are reported. Using a Schmidt telescope located in Australia, a photographic survey of the southern sky is underway. Photographic techniques and other telescope oriented research is discussed. The use of an infrared telescope located in Hawaii is also mentioned. Image and data processing services, notably the cosmos machine for making measurements on photographs, are presented. Research activities deal with extragalactic phenomena, galactic structure, and stellar astronomy among other subjects. Author (ESA)

N80-19000# Royal Greenwich Observatory, Herstmonceux (England).
DOUBLE STAR OBSERVATIONS MADE WITH THE 28-INCH REFRACTOR: 1963-1970
R. W. Argyle, M. P. Candy, and L. S. T. Symms 1979 31 p refs
(Roy-Obs-Bull-184) Avail: NTIS HC A03/MF A01; Roy. Greenwich Obs., Herstmonceux, England £ 1.00

Results of 1151 observations of 225 star pairs are given with a comparison with available orbits. The third and last series of double star observations made with the 28 inch refractor at Herstmonceux are shown. Separations were measured using the comparison image micrometer, except in a few cases when the filar micrometer was used. Most observations were made using a magnification of x685, but on occasion x1387 was used when seeing was good. The results also include several pairs which were measured between 1960 and 1962, but which were not included in the previous lists. Author (ESA)

N80-19001# Hamburger Sternwarte (West Germany).
CURRENT APPLICATIONS OF SCHMIDT TELESCOPES IN ASTRONOMY
H. J. Wendker, ed. 30 Mar. 1979 50 p refs Partly in GERMAN and ENGLISH
(ISSN-0374-1583) Avail: NTIS HC A03/MF A01

Various programs throughout the world including the use of Schmidt telescopes are reviewed. In each case the telescope is described and its applications are outlined. Programs include spectroscopic surveys, the gathering of classification criteria for late-type stars, the compilation of spectral atlases, photometric studies, measuring light curves of T Tauri stars, and radial velocity determinations with objective prism spectra as well as spectrophotometry with crossed grating and prism. Also reported are studies of minor planets, galactic structure, and extragalactic work. Operating parameters for this instrument, such as polar alignment, wind sensitivity, collimation, and guiding are also covered. Author (ESA)

N80-19002# Geneva Observatory (Switzerland).
SYNTHETIC STELLAR SPECTRA: A LIBRARY OF CALCULATION PROGRAMS [SPECTRES STELLAIRES SYNTHETIQUES: PROGRAMMES DE CALCUL]
Yves Chmielewski 1979 123 p refs In FRENCH; ENGLISH summary
(Publ-Ser-B-Fasc-7) Avail: NTIS HC A06/MF A01

Programs used to compute solar or stellar spectra by quantitative analysis assuming local thermodynamic equilibrium are described. This set of programs allows for the rapid computation of single as well as blended lines. Routines used to prepare stellar models and to compute the state of a stellar atmosphere are also described. Author (ESA)

N80-18062*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. M. Taylor In its The Deep Space Network 15 Feb. 1980 p 10-11 (For primary document see N80-18058 09-12)
Avail: NTIS HC A07/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-19003 Princeton Univ., N. J.
GALACTIC KINEMATICS OF MOLECULAR CLOUDS Ph.D. Thesis
Anthony Albert Stark 1979 95 p
Avail: Univ. Microfilms Order No. 8003795

The kinematics of molecular clouds in the galactic disk are studied to determine the magnitude of cloud to cloud velocity dispersions and systematic streaming motions. Three observational programs are reported: (1) a strip map of 1 = 180 deg from b = -9 deg to +8 deg (2) a 20 point map of the minor axis of M31; and, (3) three maps in the molecular ring, centered at 34 deg, 1 = 36 deg and 1 = 51 deg. Dissert. Abstr.

N80-19004 Nebraska Univ. - Lincoln.
AN ASTROPHYSICAL INVESTIGATION OF RADIUS AND MASS ANOMALIES AMONG SHORT PERIOD CEPHEIDS Ph.D. Thesis
Gordon David Niva 1979 118 p
Avail: Univ. Microfilms Order No. 8005300

Simultaneous photometric and spectroscopic observations were obtained for the short period Cepheids, SU Cas and TU Cas. Using these observations and a modified Wesselink method, in which the radius is obtained from a relation between the (V-R) color and the surface brightness, the radii of the stars were calculated and compared. The pulsation mode of SU Cas was tested by its position in the period radius diagram. The radius obtained gives weak support to the hypothesis that SU Cas is a first overtone pulsator. The spectroscopic radial velocities of TU Cas were combined with those of other authors and a least squares Fourier fitting technique was applied. The periods (previously obtained only from Fourier analysis of light curves) were confirmed and the time rate of change of the amplitudes of various modes was determined. Dissert. Abstr.

N80-19005 Princeton Univ., N. J.
HYDRODYNAMIC CALCULATIONS OF INTERSTELLAR CLOUD COLLISIONS Ph.D. Thesis
Mark Alan Hausman 1979 94 p
Avail: Univ. Microfilms Order No. 8003781

An algorithm for computing hydrodynamics in three dimensions treats a gas as if it were divided into a number of discrete mass-elements, each of which feels gravitational and viscous forces as well as a short-range force which simulates the effects of pressure gradients. The algorithm was used to examine the gross properties of collisions of interstellar HI clouds. A number of simulations with varying cloud mass ratios, relative velocities, and impact parameter are described. Results are examined. Dissert. Abstr.

N80-19006 California Univ., Santa Barbara.
THEORETICAL MODELS OF STELLAR FORMATION Ph.D. Thesis
Alan Paul Boss 1979 404 p

Avail: Univ. Microfilms Order No. 8003031

Theoretical models of the collapse and fragmentation of rotating interstellar clouds into single or multiple protostellar systems were constructed. A series of gravitational hydrodynamic computer codes were constructed in order to numerically follow the collapse of spherically symmetric (1 D), axially symmetric (2 D), and nonaxially symmetric (3 D) interstellar clouds. The Poisson equation for the gravitational potential is solved using a spherical harmonic expansion. The 1 D code was used to study the dynamic collapse of pressureless, isothermal, and adiabatic clouds as well as the equilibrium of an isothermal Bonnor-Ebert sphere. The 1 D code with its radiative transfer inclusion calculated the nonhomologous collapse of an initially isothermal cloud into the nonisothermal regime where rising temperature temporarily halts the collapse. The 2 D and 3 D codes were constructed so as to conserve angular momentum both locally and globally. With the 2 D code a rotating interstellar cloud collapses to form a rotating, near equilibrium ring. Numerical tests with the 2 D code as well as a completely analytic treatment of the collapse of a rotating, pressureless cloud confirm the reality of ring formation in axially symmetric clouds. The 3 D code was used to follow the collapse of rotating clouds subjected to various nonaxially symmetric perturbations. Dissert. Abstr.

N80-19007 Hawaii Univ., Honolulu.
THE FORMATION OF LATE O AND B STARS WITHIN DENSE MOLECULAR CLOUDS Ph.D. Thesis
Charles Arnold Beichman 1979 148 p
Avail: Univ. Microfilms Order No. 8003277

The dense, hot cores of 24 molecular clouds were examined at infrared wavelengths between 2.2 and 25 micron m in search of embedded, luminous objects thought to be massive O and B stars at an early stage of their evolution. Nineteen of the clouds were examined at 20 micron m for high sensitivity to sources of low color temperature between 80 and 200 K. The 20 micron m searches revealed four objects too red to be discovered in previous searches at 2.2 and 10 micron m. Results indicate that infrared sources in molecular clouds tend to form in clusters whose characteristic size is very similar to that found in trapezium-like groups of O and B stars. It seems likely that molecular clouds fragment as their densities reach 10 to the 4th power/cu cm into independently collapsing nuclei separated by about 0.1 pc and each capable of producing one (or more) star(s). Some embedded infrared sources are surrounded by a small amount of ionized material. Dissert. Abstr.

N80-19008 Florida Univ., Gainesville.
EVOLUTION OF PRE-MAIN-SEQUENCE BINARY STAR SYSTEMS Ph.D. Thesis
Jon Kenneth West 1979 221 p
Avail: Univ. Microfilms Order No. 8002914

A quasistatic polytropic model representing the pre-main-sequence contraction phase was applied to both components of close binary star systems. Models were calculated for eleven observed semi-detached close binaries published in the literature and the results were compared with the observed systems. The names and ages of the three that are likely to be pre-main-sequence are: U Caphei (610,000 years), X Trianguli (4.6 million years), and W Ursae Minoris (1.87 million years). The following four systems were found not to fit the pre-main-sequence model in this investigation: TV Cassiopeia, AI Draconis, Beta Persei, and TX Ursae Majoris. The following four systems could be pre-main-sequence with modifications to the model: Im Aurigae (350,000 years), delta Librae (820,000 years), U Sagittae (378,000 years), and V505 Sagittarii (1.89 million years).
Dissert. Abstr.

N80-19009# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFLUENCE OF THE B SUB x COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD ON MAGNETOPAUSE RECONNECTION
W. D. Gonzales and A. L. C. Gonzales Dec. 1979 12 p refs Revised Submitted for publication
(INPE-1645-RPE/101-Rev) Avail: NTIS HC A02/MF A01

The first clear evidence of an effect of the B sub x component of the interplanetary magnetic field (IMF) in magnetopause reconnection was obtained from polar ionospheric electric fields measured with balloons. This B sub x effect results in a north-south asymmetry in magnetopause reconnection, which favors one hemisphere over the other (according to the sign of B sub x) and displaces the main reconnection region from the nose to higher latitudes (according to the magnitude of B sub x). Thus, the reconnection line becomes shorter when B sub x is large enough, resulting in a smaller potential of reconnection. Author

N80-19010*# National Aeronautics and Space Administration, Washington, D. C.
THE COSMOS TODAY AND TOMORROW
E. Guseva Jan. 1980 4 p Transl. into ENGLISH from Grazhk. Aviats. (USSR), no. 5, 1979 p 27 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75736) Avail: NTIS HC A02/MF A01 CSCL 03B

The book "Tested on Oneself" is summarized and reviewed. Topics in the field of space flight and aerospace medicine are addressed. A.W.H.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

N80-19011 Kansas Univ., Lawrence.
THE DEVELOPMENT OF COMPUTER PROGRAMS TO DETERMINE ATMOSPHERIC WINDS FROM ENTRY PROBE DATA AND POSSIBLE APPLICATIONS TO THE PIONEER VENUS MISSION Ph.D. Thesis
Trevor Charles Sorensen 1979 483 p
Avail: Univ. Microfilms Order No. 8002809

Equations able to analytically determine atmospheric winds from probe entry data were derived and subsequently incorporated into a computer program to facilitate the processing and analysis of such data. The wind extraction equations used in this program depend only on an accurate determination of the actual trajectory parameters. Programs were developed to produce simulated differential long baseline interferometry and trajectory reconstruction data in order to test the applicability of the wind extraction program for analyzing the actual Pioneer Venus Mission probes entry data. From these simulated data test cases, it was concluded that the wind extraction program is able to extract the mean wind profiles from actual probe entry data of the Pioneer Venus Mission below an altitude of at least 50-60km, and if the data are of good enough quality, possibly up to about 100km altitude. Dissert. Abstr.

N80-19012 Colorado Univ. at Boulder.
CONVECTION IN ROTATING LAYERS WITH THERMAL WINDS AND APPLICATION TO JUPITER Ph.D. Thesis
David Henry Hathaway 1979 150 p
Avail: Univ. Microfilms Order No. 8002980

A linear stability analysis is carried out for fluid layers under uniform rotation which possess both vertical and horizontal temperature gradients. In order to represent various latitudes with these plane parallel layers, a rotation vector is used which is generally oblique to gravity. The configuration is used to assess the preferred convective modes as a function of latitude. Two major effects arise: (1) the tilted rotation vector introduces a preference for roll like disturbances with north-south orientations, the preference is particularly strong in the equatorial regions, and, (2) the presence of a north-south temperature gradient produces a thermal wind shear which favors axisymmetric convective rolls oriented parallel to the flow in an east-west direction. The axisymmetric cloud bands observed on the planet Jupiter is suggested to be produced by the east-west convective instabilities. A simple radiative-convective model for Jupiter is used to estimate the parameter values relevant in the stability analysis. Dissert. Abstr.

N80-19013# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

SATURN'S MAGNETOSPHERE, RINGS, AND INNER SATELLITES Progress Report

J. A. VanAllen, M. F. Thomsen, B. A. Randall, R. L. Rairden, and C. L. Grosskreutz Nov. 1979 30 p refs
(Contract N00014-76-C-0016)
(AD-A076619; Rept-79-44) Avail: NTIS HC A03/MF A01 CSCL 03/1

The 31 August - 5 September 1979 observations together with those of the other Pioneer 11 investigators provide the first thoroughly credible discovery of the magnetosphere of Saturn and many detailed characteristics thereof. In physical dimensions and energetic charged particle population, Saturn's magnetosphere is intermediate between those of Earth and Jupiter. In terms of planetary radii, the scale of Saturn's magnetosphere more nearly resembles that of Earth and there is much less inflation by entrapped plasma than in the case of Jupiter. The orbit of Titan lies in the outer fringes of the magnetosphere. Particle angular distributions on the inbound leg of the trajectory (sunward side) have a complex pattern but are everywhere consistent with a dipolar magnetic field approximately perpendicular to the planet's equator. On the outbound leg (dawn side) there are marked departures from this situation outside of 8 r sub S, suggesting an equatorial current sheet having both longitudinal and radial components. The particulate rings and inner satellites have a profound effect on the distribution of energetic particles. GRA

N80-19014# Graz Univ. (Austria). Inst. fuer Meteorologie u. Geophysik.

RECENT DATA ON PLANETS IN THE SOLAR SYSTEM [NEUE ERKENNTNISSE UEBER UNSERE PLANETEN]

Helmut Rucker Sep. 1977 44 p refs In GERMAN Presented at Austrian Physikalischen es., Leoben, West Germany, 30 Sep. 1977
Avail: NTIS HC A03/MF A01

Data collected by the Mariner, Venera, Viking and Pioneer spacecraft are reviewed. The composition and characteristics of the atmosphere, measurements of the magnetic fields and surface morphology of the planets Mercury, Venus, Mars, and Jupiter are discussed. The biological experiments carried out by the Viking missions are detailed, concluding that no positive evidence of life on Mars was found. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-19015 Kansas Univ., Lawrence.

A NUMERICAL SIMULATION OF CHARGED PARTICLE INTERACTIONS WITH INTERPLANETARY SHOCK WAVES Ph.D. Thesis

Robert Blair Decker 1979 235 p
Avail: Univ. Microfilms Order No. 8002750

A computer model, developed to numerically simulate the combined effects of a charged particle's energization at an interplanetary shock and propagation to a satellite-borne particle detector at the observation point, is described and the trajectory results examined. A charged particle's adiabatic motion is assumed to be scatter-free along the laminar spiral interplanetary magnetic field (IMF). The interplanetary shock wave is taken as a sun-centered sperical surface that expands radially outward. The plasma and field changes across the shock obey the jump conditions for a fast mode magnetohydrodynamic (MHD) shock wave. For a chosen shock model, a particle of specified observed kinetic energy and pitch angle at a given observation time and fixed observation point is followed numerically backward in time through the IMF and shock wave. The shock interaction is treated by solving the particle's exact orbit equations through the locally planar MHD shock discontinuity. Dissert. Abstr.

N80-19016 Colorado Univ. at Boulder.

SUNSPOT VECTOR MAGNETIC FIELDS AND MODEL UMBRAL ATMOSPHERES Ph.D. Thesis

Joseph Bearak Gurman 1979 205 p
Avail: Univ. Microfilms Order No. 8002978

The Stokes parameters provide a complete description of the polarization of electromagnetic radiation. The Stokes polarimeter of the High Altitude Observatory, which is capable of measuring all four Stokes parameters simultaneously across a spectral line profile, was used to observe a round, unipolar sunspot in three absorption lines and the nearby continua. Observations in the weak Zeeman triple lambda 6302.50 A are used to derive the vector magnetic field B across the spot. Doppler shift measurements in the Zeeman-insensitive line Fe I lambda 5576.10 A show no significant vertical flows in the spot. Finally, Stokes profiles of the Zeeman-sensitive resonance line Na I D2 lambda 5889.96 A are used to probe the depth variation of the magnetic field and to obtain a model atmosphere for the umbra. Combination of the weak- and strong-line results indicates a horizontal variation in the sum of gas and magnetic pressure in the umbra. Acoustic turbulence is proposed to prevent the creation of flows which are not observed. Possible scales of such turbulence are discussed. Dissert. Abstr.

N80-19017# Megatek Corp., San Diego, Calif.

LA POSTA SOLAR RADIO MAPS Technical Document, May - Sep. 1979

P. E. Argo and F. L. Wefer Sep. 1979 62 p
(Contract N00123-78-C-0043)
(AD-A076376; NOSC-TD-283) Avail: NTIS HC A04/MF A01 CSCL 03/1

The La Posta 18.3 m antenna has been used since 1972 to acquire radio maps of the solar disk at wavelengths of 0.86 and 2.0 cm. The NOSC in-house research program is supporting the continuation of this program through the peak of the present solar activity cycle (about 1981). During this period of operation, daily (5 days per week) radio maps at both wavelengths will be acquired. This report presents the radioheliogram data for the second quarter of 1979. GRA

N80-19018# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

SOLAR RADIATION TEST Final Report

Oct. 1979 18 p Supersedes MTP-4-2-826; MTP-5-2-593; MTP-6-2-532
(AD-A075734; TOP-4-2-826; MTP-4-2-826; MTP-5-2-593; MTP-6-2-532) Avail: NTIS HC A02/MF A01 CSCL 03/2

Describes methods for evaluating the effects of solar radiation and heat on military materiel and its operation through the use of environmental chambers. Includes a procedure for establishing an equivalent high temperature for use in environmental chamber high-temperature tests. GRA

N80-18469*# Crimean Astrophysical Observatory (USSR).

SOVIET SHORT-TERM FORECASTS OF ACTIVE REGION EVOLUTION AND FLARE ACTIVITY

A. B. Severny, N. N. Stepanyan, and N. V. Steshenko *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 72-88 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18470*# Institute of Applied Geophysics, Moscow (USSR).

FORECASTING OF SOLAR ENERGETIC RADIATION AT THE FORECAST CENTER OF THE INSTITUTE OF APPLIED GEOPHYSICS

S. I. Avdyushin, N. K. Pereyaslova, F. L. Dlikman, and Yu. M. Kulagin *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 89-103 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18474*# Academia Sinica, Kunming (China). Yunnan Observatory.

SPIRAL SUNSPOTS AND SOLAR ACTIVITY FORECASTS

Ding You-ji and Zhang Bai-rong *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 140-153 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18475*# Academy of Sciences, Peking (China). Solar Activity Prediction Group.

SOLAR ACTIVITY PREDICTIONS AT PEKING OBSERVATORY

In NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 154-162 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18476*# Academia Sinica, Nanking (China). Purple Mountain Observatory.
LONG-TERM FORECASTING OF SOLAR ACTIVITY
Xu Zhen-Tao, Zhao Ai-Di, Mei Yan-Lin, and Guo Quan-Shi *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 163-175 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18477*# Academia Sinica, Nanking (China). Solar Activity Prediction Group.
SHORT-TERM SOLAR ACTIVITY FORECASTING
Chen Xie-Zhen and Zhao Ai-Di *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 176-181 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18479*# Nagoya Univ., Toyokawa (Japan). Research Inst. of Atmospherics.
A REVIEW OF SHORT-TERM FLARE FORECASTING ACTIVITIES AT TOYOKAWA
Shinzo Enome *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 205-211 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18487*# Ionospheric Prediction Service, Darlinghurst (Australia). Dept. of Science and the Environment.
CORONAL HOLES INFERRED FROM THE FLEURS EAST-WEST SOLAR SCANS
Brian G. Ferguson *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 288-311 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18492*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC SOLAR ACTIVITY PREDICTIONS FOR SATELLITE ORBITAL LIFETIME ESTIMATION
H. C. Fuller, C. A. Lundquist, and W. W. Vaughan *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 378-384 refs (For primary document see N80-18462 09-42)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18493*# Michigan Univ., Pontiac. McMath-Hulbert Observatory.
EXAMPLES OF PROBLEM FLARES OR SITUATIONS IN PAST SOLAR-TERRESTRIAL OBSERVATIONS
H. W. Dodson, E. R. Hedeman, and O. C. Mohler *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 385-397 refs Sponsored in part by APL/JHU (For primary document see N80-18462 09-42)
(Grants NGL-23-005-275; NOAA-03-4-022-94)
Avail: NTIS MF A01; SOD HC CSCL 03B

N80-18495*# Air Force Geophysics Lab., Hanscom AFB, Mass.
PPS76: A COMPUTERIZED EVENT MODE SOLAR PROTON FORECASTING TECHNIQUE
D. F. Smart and M. A. Shea *In* NOAA Solar-Terrest. Predictions Proc., Vol. 1 Aug. 1979 p 406-427 refs (For primary document see N80-18462 09-42)
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93 SPACE RADIATION

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For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

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N80-19019# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 33, NUMBER 7
I. Kaufman, ed., Victoria S. Hewitson, ed. et al 31 Jul. 1979 41 p
(AD-A075097; ESN-33-7) Avail: NTIS HC A03/MF A01 CSCL 05/2

This monthly publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by calling attention to current developments and to institutions and individuals engaged in these scientific efforts. The articles are written primarily by members of the staff of ONRL. Topics in this issue include: La Renaissance du Dirigeable - A solution in search of a problem; Chemistry at Swiss Universities; Formal Design Methodology - How to design computer systems without really using your head; UK Battery Research--Air Force; Solar Energy in Greece and Egypt; Fluid Dynamics at the Technische Hogeschool Delft; The Institut fuer Hydromechanik at the University of Karlsruhe; Materials Research at Leicester, Loughborough, and Leeds; High Strength Low Alloy Steels; Preoperative Hypothermic Renal Perfusion--Another use for the arterial catheter; and Semiconductor Injection Lasers. GRA

N80-19020# Southampton Univ. (England). Inst. of Sound and Vibration Research.
[RESEARCH AND PEDAGOGY IN NOISE AND VIBRATION CONTROL] Annual Report, 1979
Mar. 1979 43 p refs
Avail: NTIS HC A03/MF A01

Research and activities for the period 1978/79 are reported. Fields covered include fluid dynamics and acoustics, automotive engineering, operational acoustics and audiology as well as structural dynamics. Work in data analysis, electronic research and development, industrial noise research and development, and in noise and vibration control is also summarized. Pedagogical activities for the year are outlined. Author (ESA)

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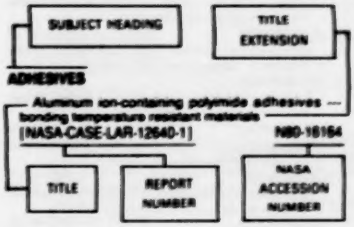

The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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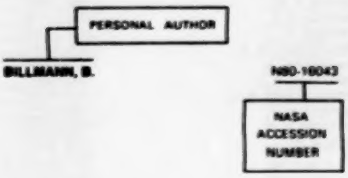

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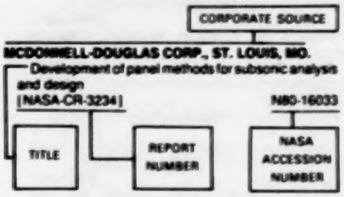
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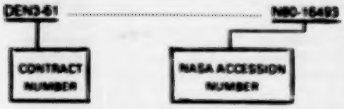

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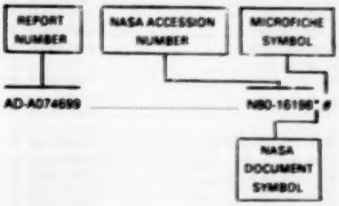

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KNMI-V-310	N80-18651 #
KNMI-V-310	N80-18668 #
KNMI-V-311	N80-18652 #
KNMI-V-312	N80-18653 #
KNMI-V-313	N80-18654 #
KNMI-V-314	N80-18656 #
KNMI-V-315	N80-18655 #
KNMI-V-317	N80-18658 #
KNMI-V-317	N80-18659 #
KNMI-V-318	N80-18660 #
KNMI-V-319	N80-18661 #
KNMI-V-320	N80-18625 #

KNMI-V-321	N80-18664 #
KNMI-V-322	N80-18665 #
KNMI-V-327	N80-18666 #
KNMI-WR-79-2	N80-18657 #
KNMI-WR-79-4	N80-18662 #
KSC-TR-28-1	N80-18366* #
L-13256	N80-18427* #
LARS-093079	N80-18515* #
LBF-FB-148	N80-18441 #
LBF-FB-149	N80-18442 #
LBF-TB-145-VOL-1	N80-18439 #
LBF-TB-145-VOL-2-APP	N80-18440 #
LBF-TB-146	N80-18438 #
LC-79-607614	N80-18249 #
LCDS-TR-79-6	N80-18851 #
LEC-4366	N80-18986* #
LEC-11651	N80-18519* #
LEC-11861	N80-18510* #
LEC-13266	N80-18087* #
LEC-13393-VOL-2	N80-18525* #
LEC-13498	N80-18509* #
LEC-14064	N80-18511* #
LG77ER0208	N80-17989* #
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LIDS-P-936	N80-18779 #
LIDS-P-953	N80-18956 #
LIDS-P-976	N80-18769* #
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LMSC-D677934	N80-18161 #
LMSC-D678462	N80-18269 #
LMSC-D678772	N80-18162 #
LR-23683	N80-18008 #
LR-28559	N80-18103* #
LR-28573	N80-18104* #
MAE-T-1465	N80-18341* #
MAE-1459	N80-18140 #
MANCP-423(79)	N80-18208 #
MANCP-424(79)	N80-18207 #
MATHEMATICS-62	N80-18860 #
MDC-G7887	N80-18974 #
MERADCOM-TQ-1	N80-18419 #
MIMEO-SER-79-26	N80-18980 #
MIMEO-SER-1249	N80-18867 #
MIMEO-SER-1257	N80-18852 #
MIT/LCS/TM-141	N80-18967 #
MIT/LCS/TR-213	N80-18817 #
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MPI-PAE/EXTRATERR-151	N80-18927 #
MPI-PAE/EXTRATERR-156	N80-18371 #
MPIS-14/1978	N80-18346 #
MPIS-17/1978	N80-18350 #
MPIS-18/1978	N80-18141 #
MPIS-19/1978	N80-18915 #
MPIS-21/1978	N80-18351 #
MPIS-26/1978	N80-18352 #
MPIS-28/1978	N80-18347 #
MRC-R-458	N80-18279 #
MRC-TRC-1971	N80-18825 #
MRC-TRC-1972	N80-18826 #
MRC-TSR-1961	N80-18829 #
MRC-TSR-1965	N80-18830 #
MRC-TSR-1966	N80-18828 #

MRC-TSR-1967 N80-18827 #
MRC-TSR-1968 N80-18824 #
MRC-TSR-1970 N80-18735 #
MRC-TSR-1973 N80-18841 #
MRC-TSR-1974 N80-18823 #
MRC-TSR-1989 N80-18840 #

MRL-R-749 N80-18154 #
MRL-R-751 N80-18379 #
MRL-R-760 N80-18703 #

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MSRR-450 N80-18871 #

MSSU-EIRS-ASE-80-2 N80-17992* #

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MTP-5-2-593 N80-19016 #
MTP-6-2-532 N80-19016 #

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NADC-79145-60 N80-18034 #
NADC-79241-60 N80-18013 #

NASA-CASE-ARC-11120-1 N80-18091*
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NASA-CASE-ARC-11248-2 N80-18180* #

NASA-CASE-FRC-11009-1 N80-18036*

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NASA-CASE-LAR-12465-1 N80-18363* #
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NASA-CASE-LEW-12277-3 N80-18300* #
NASA-CASE-LEW-12363-3 N80-18556* #
NASA-CASE-LEW-12363-4 N80-18555* #
NASA-CASE-LEW-12723-1 N80-18690*
NASA-CASE-LEW-12971-1 N80-18039*
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NASA-CASE-NPO-13606-2 N80-18364* #
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NATICK/TR-79/023 N80-18451 #

NEAR-TR-163-VOL-1 N80-18001 #
NEAR-TR-163-VOL-2 N80-18002 #

NEPRF-TR-79-02 N80-18641 #

NOAA-79090406 .... N80-18549* #

NOR-79-41 .... N80-18199 #

NOSC-TD-289 .... N80-19017 #

NPS55-79-020 .... N80-18535 #
NPS67-79-006 .... N80-18307 #

NRC/CNR-TT-1946 .... N80-18153 #

NRL-MR-4034 .... N80-18384 #
NRL-MR-4051 .... N80-18387 #
NRL-MR-4083 .... N80-18159 #
NRL-MR-4077 .... N80-18189 #
NRL-MR-4087 .... N80-18619 #
NRL-MR-4088 .... N80-18848 #
NRL-MR-4099 .... N80-18677 #
NRL-MR-4102-VOL-1 .... N80-18760 #
NRL-MR-4104 .... N80-18850 #
NRL-MR-4106 .... N80-18319 #
NRL-MR-4110 .... N80-18612 #
NRL-MR-4112 .... N80-18613 #
NRL-MR-4120 .... N80-18452 #
NRL-MR-4124 .... N80-18618 #

NRL-7958-REV .... N80-18267 #
NRL-8317 .... N80-18888 #
NRL-8350 .... N80-18129 #

NRL/NUREG-CR-0969 .... N80-18159 #

NRTC-79-8R .... N80-18315 #

NSWC/TR-79-210 .... N80-18099 #
NSWC/TR-79-289 .... N80-17996 #
NSWC/TR-79-295 .... N80-18571 #

NSWC/WOL/TR-78-58 .... N80-18079 #

NT-44-1978 .... N80-18345 #

NTIS/PS-74/113 .... N80-18589 #
NTIS/PS-75/040 .... N80-18201 #
NTIS/PS-75/060 .... N80-18736 #
NTIS/PS-75/067 .... N80-18736 #
NTIS/PS-75/140 .... N80-18417 #
NTIS/PS-75/181 .... N80-18142 #
NTIS/PS-75/613 .... N80-18145 #
NTIS/PS-75/614 .... N80-18144 #
NTIS/PS-75/615 .... N80-18142 #
NTIS/PS-75/640 .... N80-18581 #
NTIS/PS-75/666 .... N80-18422 #
NTIS/PS-75/704 .... N80-18201 #
NTIS/PS-75/753 .... N80-18736 #
NTIS/PS-75/760 .... N80-18589 #
NTIS/PS-75/790 .... N80-18323 #
NTIS/PS-75/826 .... N80-18251 #
NTIS/PS-75/838 .... N80-18417 #
NTIS/PS-75/860 .... N80-18738 #
NTIS/PS-75/884 .... N80-18895 #
NTIS/PS-76/0685 .... N80-18145 #
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OEHL-79-10 .... N80-18082 #

ONR-CR-215-246-3F .... N80-18343 #
ONR-CR-233-052-4 .... N80-18090 #
ONR-CR-233-092-1 .... N80-18026 #

ORC-79-6 .... N80-18672 #
ORC-79-7 .... N80-18670 #

ORI-TR-1686 .... N80-18586* #

OSURF-761251/711374 .... N80-18275 #
OSURF-761261/711400 .... N80-18275 #
OSURF-761454/711671 .... N80-18274 #

OSURF/760256/784174 .... N80-18044 #

PAPER-79-0217 .... N80-18136 #

PB-299867/8 .... N80-18893 #
PB-299868/8 .... N80-18894 #
PB-299890/4 .... N80-18548 #
PB-299925/8 .... N80-18547 #
PB-300723/4 .... N80-18546 #
PB-301417/2 .... N80-18549* #

PB80-101710 .... N80-18248 #
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PB80-106032 .... N80-18250 #
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PB80-802408 .... N80-18146 #

PHM-01-79 .... N80-18824 #

PM-13-79 .... N80-18412 #

PR-2 .... N80-18303 #
PR-2 .... N80-18512* #
PR-2-14/P6 .... N80-18512* #
PR-418 .... N80-18749* #
PR-3712-7 .... N80-18523* #

PRRL-79-CR-37 .... N80-18868 #

PSU-AERO-R-79/80-5 .... N80-17994* #

PTR-80-3 .... N80-18383* #

PUBL-SER-B-FASC-7 .... N80-19002 #

PUBL-201 .... N80-18458 #
PUBL-349 .... N80-18321 #

PV-38.022 .... N80-18114 #

QR-3 .... N80-18575 #
QR-5 .... N80-18310 #
QR-8 .... N80-18010* #
QR-8 .... N80-18520* #

QTR-2 .... N80-18103* #
QTR-8 .... N80-18104* #

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RAC-MDR-12 .... N80-18313 #

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